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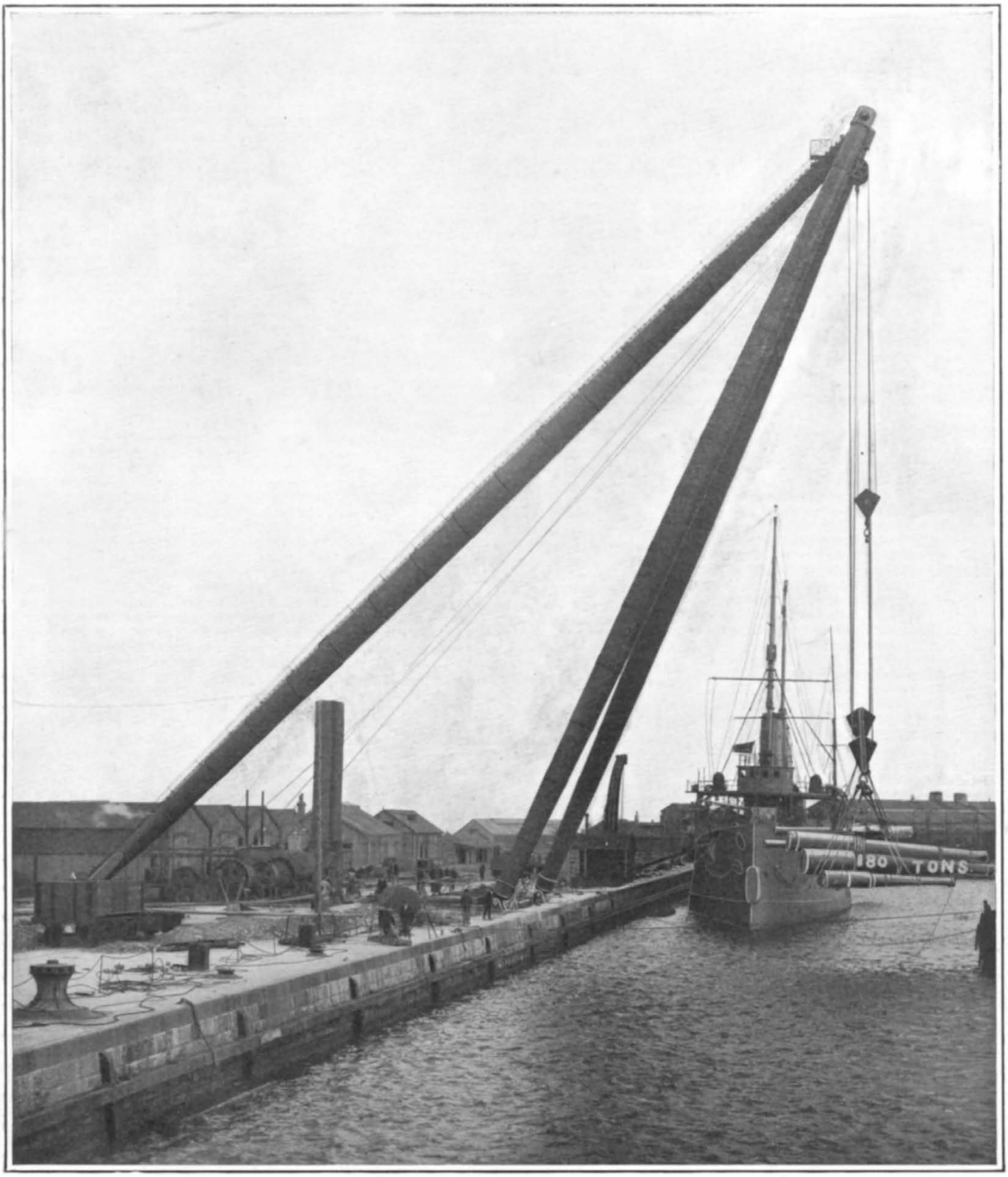
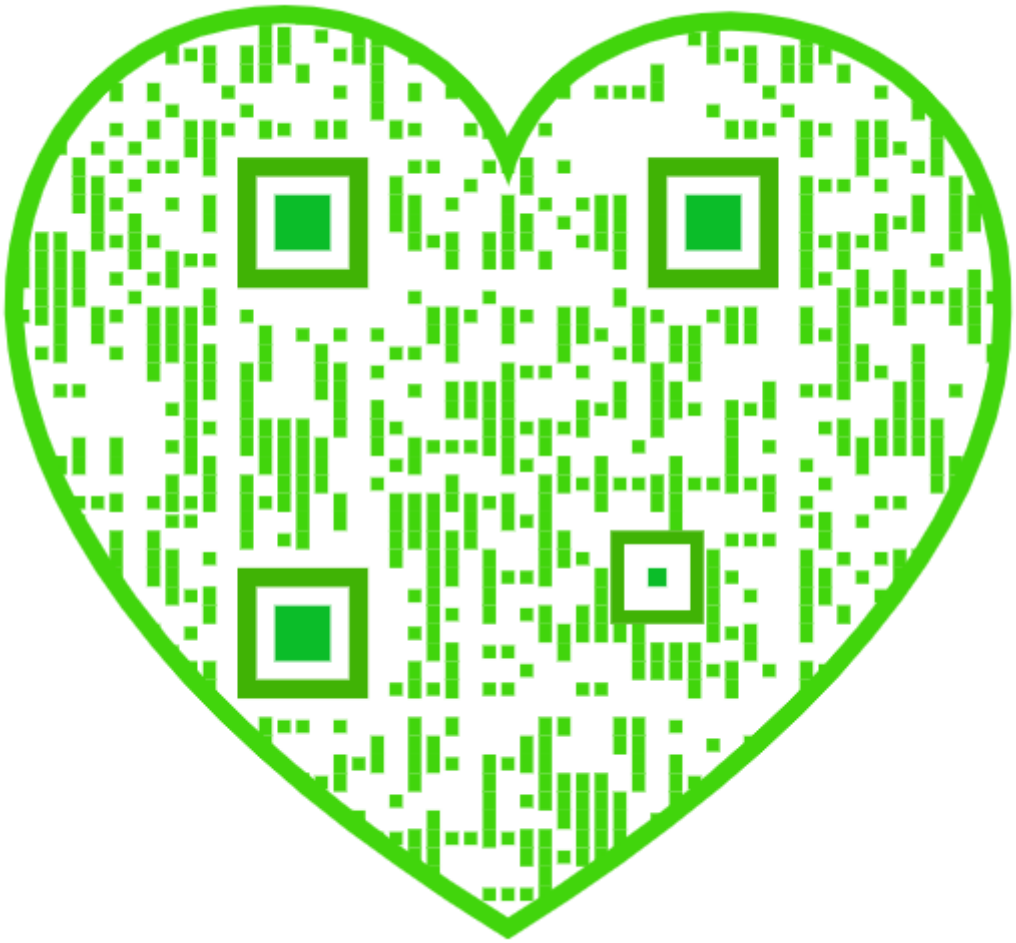


THE 180-TON SHEAR LEGS FOR THE BRITISH GOVERNMENT DOCKYARD AT CHATHAM.—[See page 258.]



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NEW YORK, SATURDAY, SEPTEMBER 30, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

BUILDING THE ERIE BARGE CANAL.

It is gratifying to know that the work of enlarging the Erie Canal to accommodate 1,000-ton barges is fairly under way. Recent reports from the State engineer on the six contracts already let state that on four of them the work is making good progress, and that plants for work on the other contracts have been established. Corps of engineers have been established at fifteen points along the line of the work between Albany and Buffalo, and at each point there is a force of from ten to forty engineers and assistants. Ground will soon be broken on the first canal lock at Waterford, on the Champlain route, and it is gratifying to learn that the Canal Board has decided to make all the locks 45 feet in width instead of 28 feet, as contemplated in the original plan. This is a wise provision which future developments will surely justify. The contracts which are now under active prosecution will involve the expenditure of between five and six million dollars. At present there is an appropriation of ten million dollars at the disposal of the canal authorities, and the Superintendent of Public Works will shortly let other contracts which will cover the balance of this appropriation.

ANOTHER NORTH RIVER TUNNEL.

In addition to the tunnel now under construction beneath the North River for the Pennsylvania Railroad, and the two tunnels now under construction by the Hudson Companies, another influential company is about to construct a new tunnel whose location will be intermediate between those of the Hudson Companies. The Interstate Tunnel Railroad Company of New Jersey, which will build the tunnel, has been incorporated with an authorized capital stock of $7,500,000. The work is to be carried out conjointly by the Metropolitan Street Surface Railway interests, which hope to secure authority to build an extensive system of subways in New York city, and by the Public Service Corporation, which operates all the surface lines in the counties of Hudson, Essex, Passaic, Union, and Middlesex in New Jersey, a total of about 550 miles of line. As part of the scheme, a new direct, high-speed line will be built from Newark, to afford communication, without changing, with the proposed tunnel in Jersey City, and it is proposed to have a schedule which will allow the trip to be made from Newark to the City Hall in New York in fifteen minutes, and between Jersey City and the Manhattan terminal of the tunnel in five minutes' time. The tunnel will run from a terminus in Jersey City at Erie and 12th Street, to a terminus under Chambers Street, between Broadway and the Brooklyn Bridge terminal. Arrangements have been made for a joint passenger station at Jersey City which will enable the Erie Railway Company to transfer its suburban passengers to the new tunnel line.

MAGNETIC SURVEY OF THE NORTH PACIFIC OCEAN.

The Department of International Research in Terrestrial Magnetism of the Carnegie Institution of Washington is about to make a magnetic survey of the North Pacific Ocean. The brig "Galilee," a wooden sailing vessel, has been fitted out at San Francisco for the expedition. The purpose of the expedition is to get exact data of the distribution of magnetic forces over the ocean, the present magnetic charts used by navigators of the North Pacific depending chiefly upon observations made on islands and along the coasts. Observations of this kind are subject to disturbance by local conditions, so that the charts now in use are not trustworthy. It is thought that the work can be accomplished in three years and the sum of $20,000 has been allotted for the expenses of the first year. The "Galilee" will first cruise from San Francisco to San Diego, thence to Honolulu and back to San Francisco. Then a circuit will be made from the west coast of America to the Galapagos Islands, and thence to the Philippine Islands and Japan, returning by way of the Aleutian Islands and closing the circuit at San Francisco. The observations will be continued over a series of areas bounded by parallels of latitude and meridians of longitude each five degrees apart, lying next on the mid-ocean side of the circuit last made, proceeding gradually and by successive circuits into the central region of the North Pacific Ocean. The whole length of the course proposed is 70,000 knots. The work is directed by Dr. L. A. Bauer, who is in charge of the magnetic work of the U. S. Coast and Geodetic Survey. He will accompany the expedition to San Diego. The vessel will carry a sailing master and nine men as crew. The scientific head and commander is J. F. Pratt of the U. S. Coast and Geodetic Survey, who has had thirty years' experience in geodetic, astronomical, hydrographic and magnetic work.

CHAINS VERSUS CABLES IN THE MANHATTAN BRIDGE.

On another page of this issue we publish a letter relating to the Manhattan Bridge, which affords an example of the futility of attempting to solve a complicated question by discussing merely one element thereof. The determination of the relative weight and cost of the cables of a long-span suspension bridge of 1,400 feet and over is so complicated and involves so many considerations peculiar to the type, that there are only a few engineers in this country to-day who have had occasion to master the problem in all its details. We would suggest to our correspondent that the rough-and-ready method by which he arrives at his conclusion that a chain cable for the Manhattan Bridge would cost $4,000,000 more than a wire cable, might raise a reasonable doubt as to whether he was entitled to be included among the few above referred to.

That the weight of an eye-bar chain is greater than that of a wire cable of equal strength, is a fact familiar to all engineers. But to determine just how much is the difference in weight in any given case, is not the simple matter which Mr. Hildenbrand desires to demonstrate. He failed to convince the board of eminent engineers, who passed upon the chain design and unanimously recommended its construction, even after they had listened to our correspondent's arguments.

It does not follow that a chain suspension bridge must necessarily, by reason of its greater weight, cost more than a wire suspension bridge. Moreover, the greater weight and inertia of a chain suspension bridge are most valuable qualities contributory to greater stiffness and durability. This fact was recognized in the design for the Buda-Pesth structure, where the question as to whether eye-bar chain or wire cable should be used, was, we are informed, most carefully considered, purely on its merits, before a final decision in favor of chains was reached.

Comparisons of designs, to be of any value, must be made as a whole, and not on the basis of single features, unrelated to other features. It is not necessary to *guess* the relative values of eye-bar chains and wire cables in the two Manhattan Bridge designs, because they are matters of public record. Plans for both have been worked out and are before us. In the chain design, each chain had a maximum section of 635 square inches and a minimum section of 476 square inches, or an average section of 555 square inches, while the section for the wire cables is given as 275 square inches uniform throughout. Therefore, the sections are very nearly as 2 to 1, that is, the chain cable is about twice as heavy as the wire cable, instead of 4.84 times heavier, as Mr. Hildenbrand desires us to believe. A further corroboration of these proportions is to be found in the total quantities. The weight of the eye-bar chains was published as 14,200 tons, and the weight of the wire cables as round 7,000 tons, both weights including necessary details.

Bearing in mind that in a comparison of costs the whole work, including anchor chains, suspenders, trusses, and roadway must be included in the calculation, and not merely the chains alone, the following facts have an important bearing: The steel tonnage of the superstructure of the Blackwell's Island Bridge, as published, is 42,150 tons, including 6,200 tons of nickel-steel eye-bars and pins, and it was contracted for $5,132,985. The steel tonnage for the superstructure of the chain design of the Manhattan Bridge was published as 45,000 tons, which is only 7 per cent larger than that for the Blackwell's Island structure, although of course, the former includes a much larger proportion of nickel-steel. The character of work for this design was considered by bridge contractors prepared to bid on it to be the same as that for the Blackwell's Island Bridge; that is, typical American pin connections for the chains and trusses, and the erection no more expensive than for that heavy cantilever structure. The cost of the superstructure, allowing for the larger proportion of nickel-steel, could, therefore, have been reasonably expected to be below $6,000,000.

The steel tonnage of the wire cable design is given as 41,700 tons, for which the lowest bid was $7,285,000. Although, as may be seen, the steel tonnage of the Manhattan Bridge is somewhat lighter than that for the Blackwell's Island Bridge, it is, nevertheless, over two million dollars more expensive by reason of the high-priced steel wire cables and other wire work preferred by the present Bridge Department. If to the difference of $1,285,000 between the lowest bid for the wire cable bridge and the very probable cost of the chain design be added the greater cost of the two anchorages for the wire cable design, by reason of the large mass of masonry and foundations, as shown on the plans for the same, then $2,000,000 appears to be a fair estimate of the greater cost of the wire cable design over the chain design.

For a more accurate comparison, strain sheets are essential, because from them only can it be determined whether the computations have been properly made. Strain sheets for the chain design have been published and discussed, and their accuracy has not been questioned. Of the wire cable design no strain sheet has been published, or given out to contractors, which we believe is an unprecedented procedure in American bridge practice. Above all, three facts stand out prominently: First, that the chain design has been approved and recommended for erection by a board of five eminent bridge engineers, and that it was discarded for reasons which apparently will not bear the light of examination by experts; second, that the Department of Bridges declined to submit the new wire-cable design to a similar board of experts for comparison with the discarded chain design; and, thirdly, that the Bridge Department refused to invite bids on both designs. One of the reasons alleged for such refusal was that the plans for the chain design were incomplete. We are informed by engineers who saw them, that the plans are in the same state of completeness as those for the Blackwell's Island structure on which bids were obtained.

The policy of investigating and deliberating on the plans for large engineering work has long been practised abroad; it is now going on with the plans for the Panama Canal; it should be the practice for all costly public works of this country. There can be no greater honor to an engineer than to obtain for his plans the indorsement of a board of leading experts, and instead of opposing such action engineers should solicit it for their own vindication.

TRADE MARKS ON COPYRIGHTED WORKS.

The public has again been reminded of the ineffective remedies afforded by the United States copyright statutes, by the action taken to punish Garrett J. Cauchois for the alleged infringement of a trade mark printed on copyrighted sheet music. The inability to secure redress under the copyright statutes led the proprietor of the copyright to institute criminal proceedings under provisions of the New York Penal Code, making it a misdemeanor to willfully infringe a trade mark. The defense was that the publishers of the music were endeavoring to enforce their copyright rights under the New York trade mark statute, and that if they were entitled to redress their remedy was under the Federal copyright law.

The remedies afforded for the infringement of a copyright are not uniform, and in the case of all works, excepting books and the play right in dramas and musical compositions, the amount recovered for the infringement, which depends on the number of copies of the work found in the possession of the infringer and in some cases the copies which have been sold, is in the nature of a penalty instead of as damages, with the necessity of dividing the amount recovered with the United States. In the case of a musical composition, unlike most other cases where the amount recovered for the infringement is in the nature of a penalty, there is no minimum or maximum amount prescribed which may be recovered, and unless the proprietor of the copyright can find a number of copies of the infringing work in the possession of the infringer, he is unable to obtain redress for the injury occasioned by the infringement. Even then he is unable to obtain satisfaction unless the defendant is in possession of sufficient property to pay the judgment. The infringer is therefore often able to go unpunished, except where a copyrighted drama or musical composition is unlawfully and willfully performed for profit, when the infringer is guilty of a misdemeanor.

The defendant applied for a writ of habeas corpus, which was dismissed by Justice Downing in the New York Supreme Court. In his opinion the justice said that "there was no question in the case of any violation of the copyright law. The prisoner was charged with knowingly selling articles of merchandise, which term included sheet music, to which a false and fraudulent trade mark was affixed. Entirely apart from the property protection itself secured to the author by copyright, there is the protection afforded to any trade mark used by the publisher or seller of copies for public use. If no trade marks were used by the publisher, no crime could be charged herein for merely pirating a copyrighted musical composition, but the

offense charged is clearly a crime within the meaning of the Penal Code."

At this time, when the inconsistencies in the copyright law are being considered with a view to the enactment of a new law in which they will be remedied, it is hoped that Congress will consider the question of the insertion of a provision in the statutes which will make the willful infringer of a copyright subject to such damages and penalties as will act as a deterrent and will make it possible for authors and artists to recover a more reasonable sum as damages for infringements instead of penalties, which are difficult to obtain judgment on and are often small in amount, with the necessity of dividing them with the United States.

VANDERBILT CUP ELIMINATION TRIALS.

Of recent years the elimination trials for the international automobile races have assumed an importance, and excited an amount of interest, second only to that of the races themselves. The elimination trials to select the five machines which are to represent America on the 14th of October next in the annual race for the international trophy, presented by Mr. Vanderbilt, were run off most successfully on September 23. They were held over the same course on Long Island on which the cup race will take place; and the careful work which has been done, in oiling the road and banking the sharp turns, appears to have produced a better race-track and certainly one incurring less risks than that over which the race of last year was held. The starting point was at Mineola, and the first few miles as far as Jericho were over roads that formed a part of last year's course. At Jericho, however, the course turned to the left toward the Sound, and passed through East Norwich, Greenvale, by Lake Surprise, through New Hyde Park, and back to Mineola. In the cup race, ten circuits of the course will be made. In the elimination trials, however, the cars made the circuit of 28.3 miles only four times; the total length of the race, as thus run, being 113.2 miles.

The list of entries included twelve different cars, and of these ten were sent off promptly at two-minute intervals. The starters included a Haynes car, two Pope-Toledoes, a Matheson car, a White steamer, a Locomobile, a Christie, a Royal Tourist, a Thomas, and a Franklin. The fastest time was made by a Pope-Toledo, 60-horse-power machine, which covered the course in 2 hours, 0 minutes, 50 seconds, at an average speed of 56.20 miles per hour, the fastest lap being run in 27 minutes 58 seconds. The next fastest time was made by a 90-horse-power Locomobile, in 2 hours, 1 minute, and 49 seconds. Then followed the 40-horse-power Royal Tourist in 2 hours, 19 minutes, and 18 seconds; the 50-horse-power Haynes in 2 hours, 23 minutes, 32 seconds; and the 60-horse-power Thomas, which made the circuit in 2 hours, 29 minutes, and 40 seconds. A marked feature of the running of the successful cars was that they maintained a remarkably uniform speed, a fact which augurs well for their performance when they compete with the foreign entries over the 283-mile course on October 14.

IS RADIUM THE CAUSE OF THE SUN'S HEAT AND LIGHT?*

BY PROF. G. H. DARWIN.

If, as has been argued, tidal friction has played so important a part in the history of the earth and moon, it might be expected that the like should be true of the other planets and satellites, and of the planets themselves in their relationship to the sun. But numerical examination of the several cases proves conclusively that this cannot have been the case. The relationship of the moon to the earth is, in fact, quite exceptional in the solar system, and we have still to rely on such theories as that of Laplace for the explanation of the main outlines of the solar system.

I have not yet mentioned the time occupied by the sequence of events sketched out in the various schemes of cosmogony, and the question of cosmical time is a thorny and controversial one.

Our ideas are absolutely blank as to the time requisite for the evolution either according to Laplace's nebular hypothesis, or the meteoric theory. All we can assert is that they demand enormous intervals of time as estimated in years.

The theory of tidal friction stands alone among these evolutionary speculations in that we can establish an exact, but merely relative, time-scale for every stage of the process. Although it is true that the value in years of the unit of time remains unknown, yet it is possible to determine a period in years which must be shorter than that in which the whole history is comprised. If at every moment since the birth of the moon tidal friction had always been at work in such a way as to produce the greatest possible effect, then we should find that sixty million years would be consumed in this portion of evolutionary history. The true period must be much greater, and it does not seem unreasonable to suppose that 500 to 1,000 million years may have elapsed since the birth of the moon. Such an estimate would not seem extravagant to geologists who have, in various ways, made exceedingly rough determinations of geological periods.

As far as my knowledge goes, I should say that pure geology points to some period intermediate between 50 and 1,000 millions of years, the upper limit being more doubtful than the lower. Thus far we do not find anything which renders the tidal theory of evolution untenable.

But the physicists have formed estimates in other ways which, until recently, seemed to demand in the most imperative manner a far lower scale of time. According to all theories of cosmogony, the sun is a star which became heated in the process of its condensation from a condition of wide dispersion. When a meteoric stone falls into the sun the arrest of its previous motion gives rise to heat, just as the blow of a horse's shoe on a stone makes a spark. The fall of countless meteoric stones, or the condensation of a rarefied gas, was supposed to be the sole cause of the sun's high temperature.

Since the mass of the sun is known, the total amount of the heat generated in it, in whatever mode it was formed, can be estimated with a considerable amount of precision. The heat received at the earth from the sun can also be measured with some accuracy, and hence it is a mere matter of calculation to determine how much heat the sun sends out in a year. The total heat which can have been generated in the sun divided by the annual output gives a quotient of about twenty millions. Hence it seemed to be imperatively necessary that the whole history of the solar system should be comprised within some twenty millions of years.

This argument, which is due to Helmholtz, appeared to be absolutely crushing, and for the last forty years the physicists have been accustomed to tell the geologists that they must moderate their claims. But for myself I have always believed that the geologists were more nearly correct than the physicists, notwithstanding the fact that appearances were so strongly against them.

And now, at length, relief has come to the strained relations between the two parties, for the recent marvelous discoveries in physics show that concentration of matter is not the only source from which the sun may draw its heat.

Radium is a substance which is perhaps millions of times more powerful than dynamite. Thus it is estimated that an ounce of radium would contain enough power to raise 10,000 tons a mile above the earth's surface. Another way of stating the same estimate is this: the energy needed to tow a ship of 12,000 tons a distance of 6,000 sea miles at fifteen knots is contained in twenty-two ounces of radium. The "Saxon" probably burns five or six thousand tons of coal on a voyage of approximately the same length. Other lines of argument tend in the same direction.

Now, we know that the earth contains radio-active materials, and it is safe to assume that it forms in some degree a sample of the materials of the solar system; hence it is almost certain that the sun is radio-active also.

This branch of science is as yet but in its infancy, but we already see how unsafe it is to dogmatize on the potentialities of matter. It appears, then, that the physical argument is not susceptible of a greater degree of certainty than that of the geologists, and the scale of geological time remains in great measure unknown.

*Abstract from an address delivered before the British Association for the Advancement of Science, Johannesburg, South Africa, August 30.

PATENTS FOR EXPORTED ARTICLES.—PRACTICAL ADVICE TO MANUFACTURERS.

Consul-General Mason contributes a report from Mr. Robert Grimshaw on the importance of securing patents on articles imported into Germany when such articles are patentable. His letter follows:

"I have often had occasion to write American manufacturers and exporters on the subject of having what they have to sell in Europe patented in the countries where they wish to sell them, and in some cases what I have to say has taken effect. But I should be glad of an opportunity to say, for the benefit of manufacturers as a class and for that of American export trade as a whole, some of the things that I have said from time to time to individuals. From the point of view of the manufacturer patenting is desirable, because it prevents the foreigner from doing what he has otherwise every legal right to do at any time that he sees that a foreign invention is meeting with success, and possibly success at his expense, in that it is being sold in his territory and supplanting his own products, viz., make and use of it.

"From the point of view of the selling agent in Europe, who is asked to spend time and money doing missionary work, the desirability of patenting the new thing is evident from the first, and the conviction strengthens with the success of the agent in the unprotected territory. For the manufacturer has at least the protection of home patents, and if through leaving himself unprotected he loses his foreign fields, he has at least his own country to work in with no one to say him nay. But the selling agent abroad, who has put in hard work to convince a very conservative public of the superiority of the new thing (a task which is none of the lightest, especially if there is a marked difference in first cost against the novelty) is cut out completely. This digging wells half down to water is seldom relished even by the most philosophic and philanthropic of agents.

"But when we consider the question solely from these two standpoints we have still by no means got a full view thereof. There is the customer to consider. He does not want to buy a lawsuit with a machine or other purchase. In case the article to be sold is not patented in the country in which it is offered for sale there is the danger that it has already been patented by another, and that the patentee will very justly bring against the purchaser an action for infringement of his chartered rights. In this danger the resident agent—the missionary—participates. It is useless to assure the customer that the manufacturer is one of the largest concerns in his native country, and will protect the purchaser against any possible suits for infringement. In the first place the customer has no means of verifying the statement about the financial weight of the manufacturer, and in the second he does not care; he does not wish to be annoyed by any suits, no matter how heavily he may be backed up. In the third place, if he knows anything about German patent law, and the case is a German one, he will quietly remind the missionary that in that country the infringement of a patent is not merely a civil but a criminal offense; and no manufacturer in America, however influential in financial circles, can get around that part of the difficulty. Section 36 of the German patent law of April 7, 1891, says: 'Whoever knowingly uses an invention contrary to the ordinances in sections 4 and 5 will be punished with a fine of 5,000 marks or with imprisonment not to exceed one year.' The quoted sections 4 and 5 are those which secure to the inventor the sole rights of the invention which he patents.

"Further, there are many manufacturers who seek to convey to their agents and to the customers the impression that the matter is patented in the country of sale, not by directly saying so, but by implication. Sometimes this implication is only one of silence; but for all that the attempt, whether unlawful or not, is dangerous in most countries, and especially in Germany. For section 40, of the law already quoted, says distinctly that whoever marks objects or their packages with any sign calculated to impress one falsely with the idea that the object is patented according to the German law shall pay a fine of 1,000 marks. I had been for months in correspondence with the European general agency of an American manufacturer. To get a definite answer, or even any answer at all as to patents, was next to impossible. At last, however, I got the following: 'Our friends, the ———— Company, apologize for the delay in answering our letters about patents, which they say has occurred through oversight. They write: "As you may be aware, probably, we have a great number of persons applying for patents in our own and foreign countries, and to possess you of definite information concerning them would be rather a difficult matter. It will, however, suffice and be entirely satisfactory to you to say that we will fully protect our customers against damages resulting from any lawsuits brought against them by reason of the use of our devices."'"

THE CURRENT SUPPLEMENT.

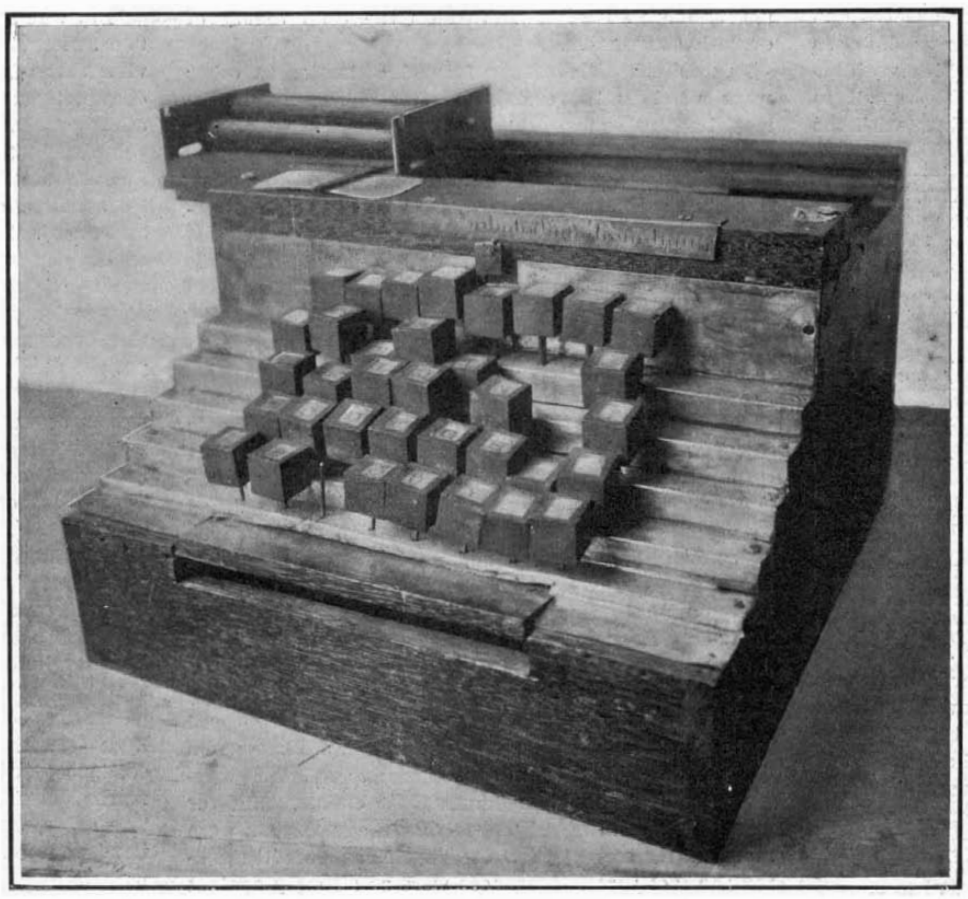
Dr. Alfred Gradenwitz opens the current SUPPLEMENT, No. 1552, with an article on Improved Methods of Tele-Photography, illustrating his article with actual photographs. Hydrocarbon Oils and Their Value as Lubricants has been taken as the subject of a very thorough article by Frank Harris Floyd. Unquestionably one of the most important investigations in physiological chemistry at the present time is the study of soluble ferments. These are briefly and yet comprehensibly reviewed by Mr. J. H. Long. While there are but few scientific workers who are not more or less expert photographers, few of these possess an adequate knowledge of the laws which define the reactions of the photographic dry plate. For such, a paper by C. E. Kenneth Mees, on the Testing of Photographic Dry Plates, will prove of exceptional value, inasmuch as the paper is both exhaustive in its treatment and copiously illustrated. Robert H. Smith writes on High-Speed Steam and Electric Railways. Albert Mann presents a scientific and yet an absorbingly interesting account of Diatoms, supplementing his text with many excellent illustrations. Clarence M. Weed gives the result of some experiments in destroying black flies. Sir William White writes on submarine signals. A thorough article on the first producer-gas boat is published, which fittingly describes one of the most noteworthy technical achievements of recent years. Sir William Crookes's article on Diamonds is continued.

AN EARLY TYPEWRITER.

So widespread and general is the use of the typewriter in nearly every phase of the world's activity to-day, that it is difficult for us to realize that it is strictly a modern invention and that the first practical commercial writing-machine was placed upon the market little over a quarter of a century ago. Notwithstanding that the main elements of the mechanism had been invented by the early sixties, they were not practically embodied in one machine till the first Sholes typewriter, the forerunner of the modern Remington, appeared in 1873. Curiously enough, Mr. Sholes collaborating later with Glidden and Soulé, was induced to attempt the construction of a typewriter, by an article in the SCIENTIFIC AMERICAN, describing an invention of John Pratt, called the "pterotype," a curious but rather useless form of writing machine. The accompanying engraving is of one of the earlier forms of typewriter, broadly a predecessor of the present-day machine. It was constructed by R. T. P. Allen, who was granted a patent covering the invention, in 1876, only three years after the appearance of the first Remington typewriter.

In Allen's machine, the carriage is moved back for a new line, by means of a cord, pulley, and weight, the last named sliding in a suitable casing at the inside of the frame, and in the other direction, by a cord and button, the weight serving in connection with a double pawl to move the paper laterally, with each marking of a type, while the button serves to bring the carriage and paper back to admit the forward feeding of the latter for the next line. The types are arranged in a circular "basket" so as to strike a common center, and are connected by curved type-rods and levers with keys disposed in a manner similar to the arrangement in the ordinary typewriter of to-day. The movable carriage and paper-feeding mechanism is arranged at the upper or top part of the framework, while in front of the same the keys are disposed in the step-shaped manner shown. The keys, arranged according to frequency and convenience of use, are connected by downward descending wire rods with a corresponding number of parallel levers that are fulcrumed to cross pivots of the frame and extended backward, carrying at their rear ends the type-rods, which are curved in an upward and inward direction toward a common center, being guided by suitable guide plates.

As the type-operating levers are arranged to pass below a vibrating pawl-operating bar, the depression of each key produces the action of the double pawl. The spaces between the words are formed by the depression of a space-bar. The paper is fed forward for the space required between the lines by means of two feed rollers, of which one is placed above the other, journaled to suitable supports of the carriage, and which act automatically with the same. The shaft of the lower roller is provided with a ratchet wheel and check pawl to prevent backward motion. The shaft of the lower roller is provided with a spur wheel whose radially extending and equidistant teeth are engaged by the free end of a band-spring that is affixed at one end to the frame of the machine, and so twisted or shaped that it presses against one of the spokes when the carriage is drawn back, turning thereby the spur wheel and the feed rollers to the distance required between the lines. This spring may be further arranged to strike a bell when releasing the adjoining spur of the wheel, in order to indicate the approaching end of the travel of the carriage. The carriage is also provided with an indicating pointer running along a graduated scale at the front part of the casing, to enable the operator to see at any time the distance to which the line is printed and when it is completed.



A TYPEWRITER OF 1876.

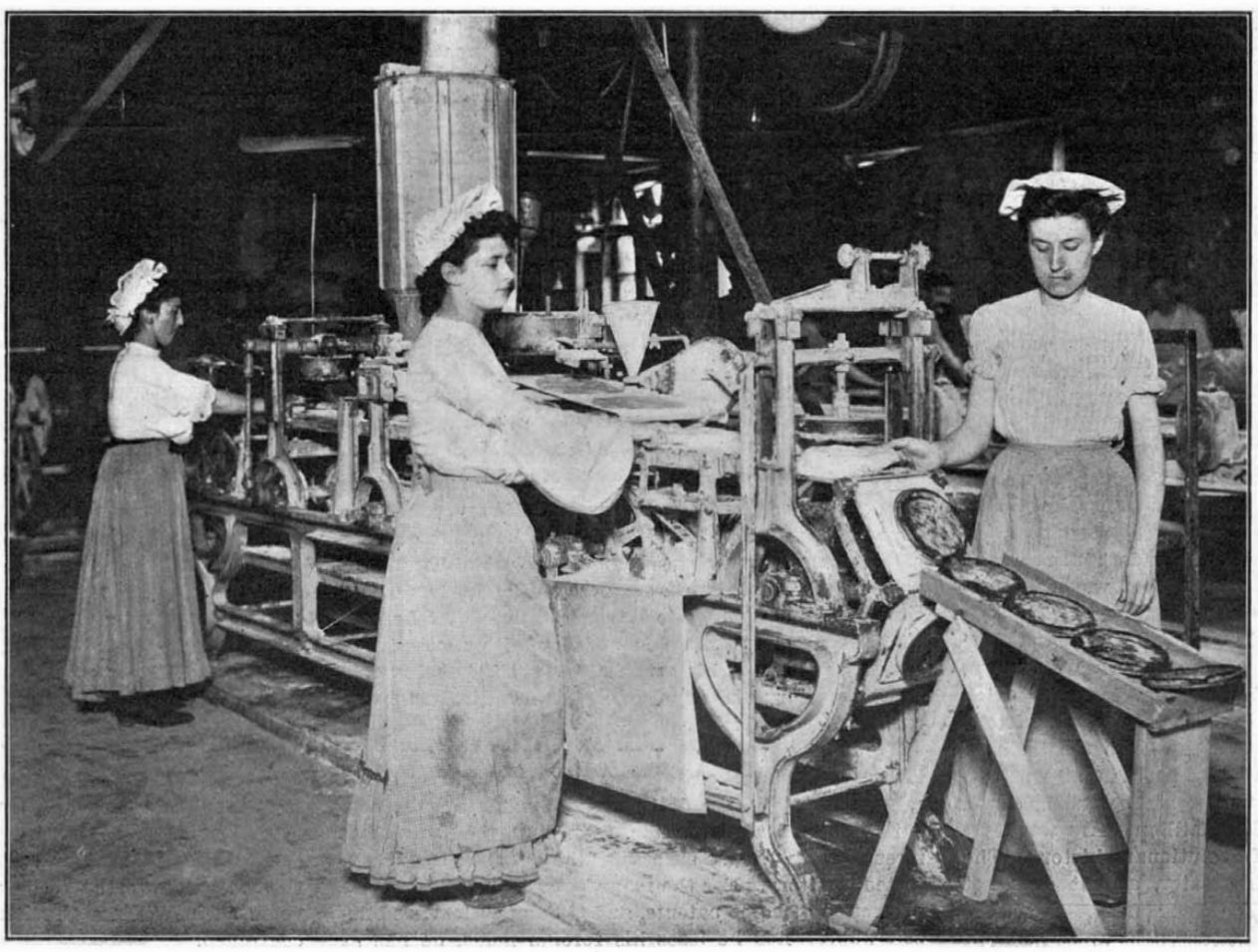
PIE-MAKING BY MACHINERY.

Another severe blow for the arts and crafts has resulted from the arrival in Philadelphia of the pie-making machine. It has always been supposed that making pies was a work for human fingers. Despite the inroads of machinery on the crafts, the pie artisan has stood alone, untouched by modern inventiveness. It was thought that a pie was too complicated and individual a creation ever to be produced by brainless mixers and trimmers and stampers.

Now comes this pie-making machine, to standardize the pie and destroy its individuality and then to multiply and cheapen it. One man, three boys, and the machine turn out from sixteen to eighteen pies a minute in the Philadelphia bakery where the pioneer machine has been installed. The inventor describes his contrivance as a boon to the human race, about 10 feet long and 20 inches wide. An electric motor furnishes power and a gas jet keeps the forming dies warm. Over the machine is suspended a tank with "filling" for 400 pies and in it an agitator revolves to keep the material from blocking the outlet.

After the paste for crusts has been properly mixed it is weighed and cut into proper-sized pieces by a dough divider. A tray full of lumps of dough for bottom crusts is placed at one end of the machine and another tray, containing lumps for top crusts, at the other end. At the rear is a stack of plates automatically fed by a ratchet. A magnetized arm swings around, picks up a plate and places it on a die made to receive it. A piece of dough is placed on the plate and the next movement brings it under a die which forms the lower crust. Then the fruit is deposited from the tank and the plate moves forward. By this time another lump of dough has been flattened out and stamped with an initial—such as "L," for lemon—while an automatic bellows blows a puff of flour over the dough to keep it from sticking. The next movement brings the filled pie and this upper crust together, one operator being stationed here to adjust the top cover if necessary. Then the covered pie comes under the edging die, which cuts off all scraps and the pie passes forward on an apron which leads to the oven.

So the process goes on with all regularity until 400 pies are lined up. They are all perfect—too perfect, perhaps. They are machine-made, and no contaminating hand has touched them from their initial stage of doughiness until they are ready to be taken from the oven—and therein lies their chief virtue.



PIE-MAKING BY MACHINERY

A Poisonous Product Extracted from the Brain of Animals.

In the course of researches on inoculation of animals against rabies by means of filtrates from animal brains, Prof. A. Marie found the animals to be considerably weakened. Now in a paper recently presented to the French Academy of Sciences, the author shows that an extremely toxical product is extracted from such emulsions of brain substance.

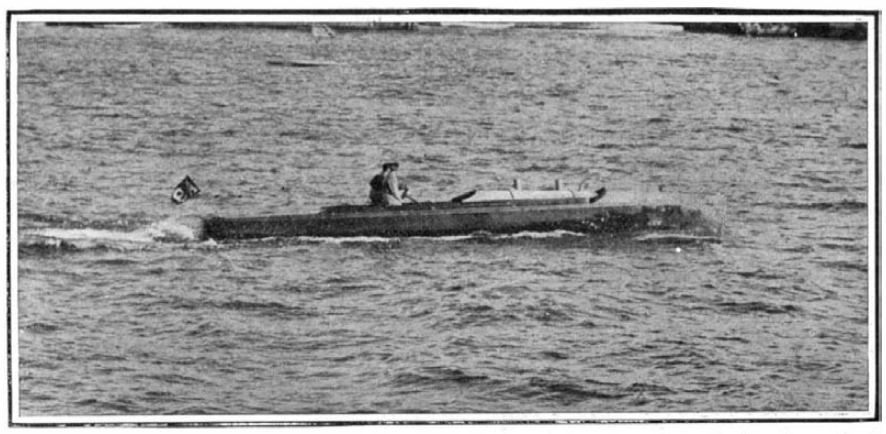
The substance in question is quite insoluble in distilled water, but is partly soluble in weak alkaline solutions, having a neurotoxical action, as shown by inoculation in the brain of rabbits. During the first few hours after inoculation the animal remains in a quite normal condition; but a most violent crisis is observed one or two days afterward, and after several similar crises the animal dies. It is interesting to note that on opening the skull, no lesion can be noted, while the brain on being inoculated in another animal does not give rise to any trouble. In some cases, however, the rabbits thus treated recover.

Endeavors so far made to vaccinate or to prepare an active serum against this poison have failed to give any satisfactory results.

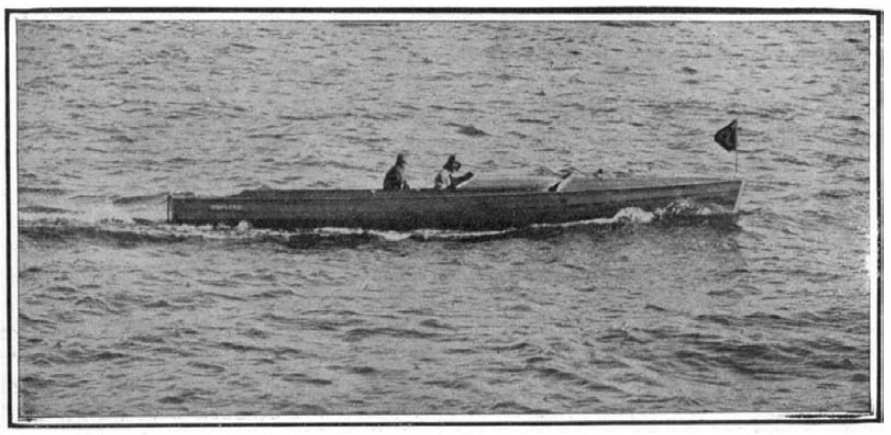
The author intends to investigate the toxicity of emulsions from the brain of man.

Artificial Camphor.

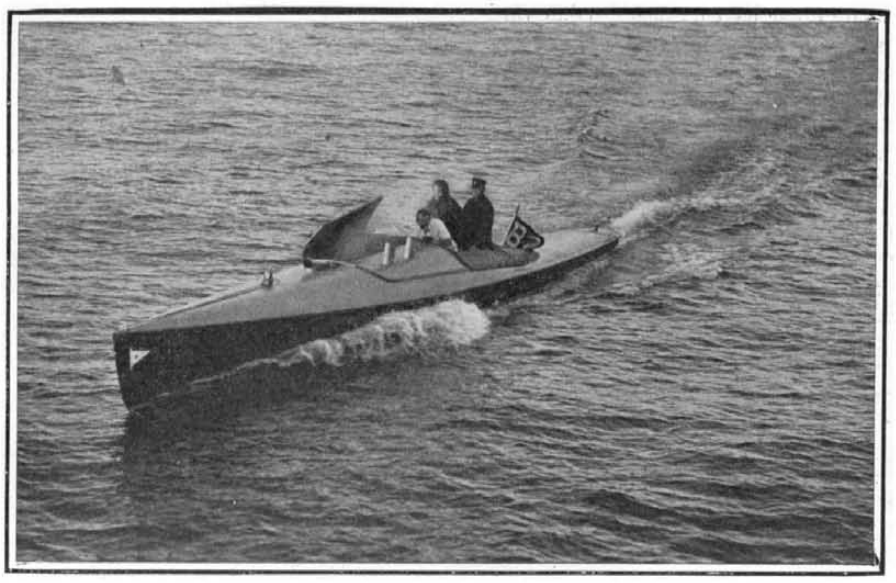
Herr Callenberg has produced pure artificial camphor in Germany, the product being designated scientifically under the name of chlorhydrate of turpentine. It is said to be soluble in nitro-glycerine, and to lower considerably the temperature of explosion of this substance, and at the same time its congelation point,



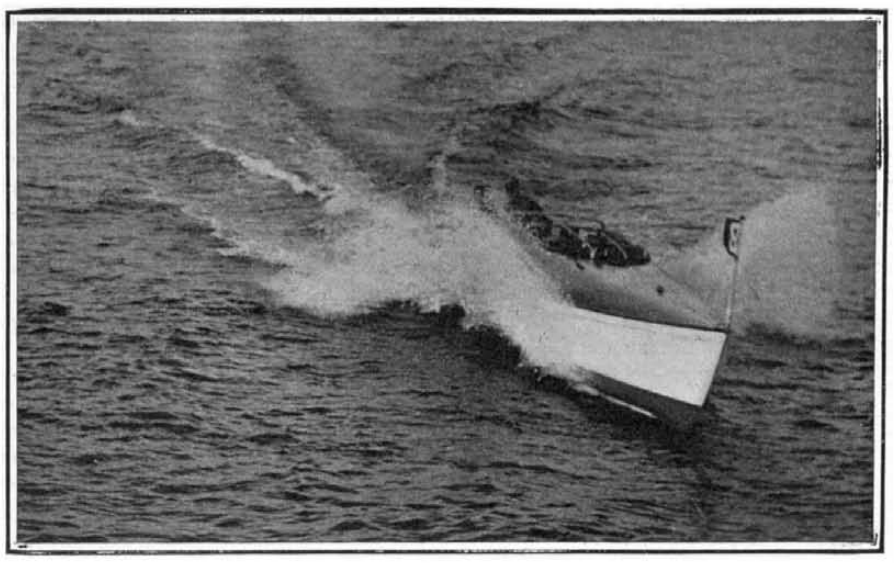
The 150-Horse-Power "Dixie," Which Won the International Trophy and, in One Circuit of the 10-Nautical-Mile Course, Developed a Speed of 24.19 Knots (27.82 Statute Miles an Hour).



The 30-Horse-Power "Simplex III." Which Won the 136-Mile Race to Poughkeepsie and Return at an Average Speed of 17.95 Miles an Hour.



The 75-Horse-Power "XPDNC," Which Won the National Trophy and Maintained a Speed of 21.41 Knots (24.68 Statute Miles an Hour) Over a 30-Nautical-Mile Course.



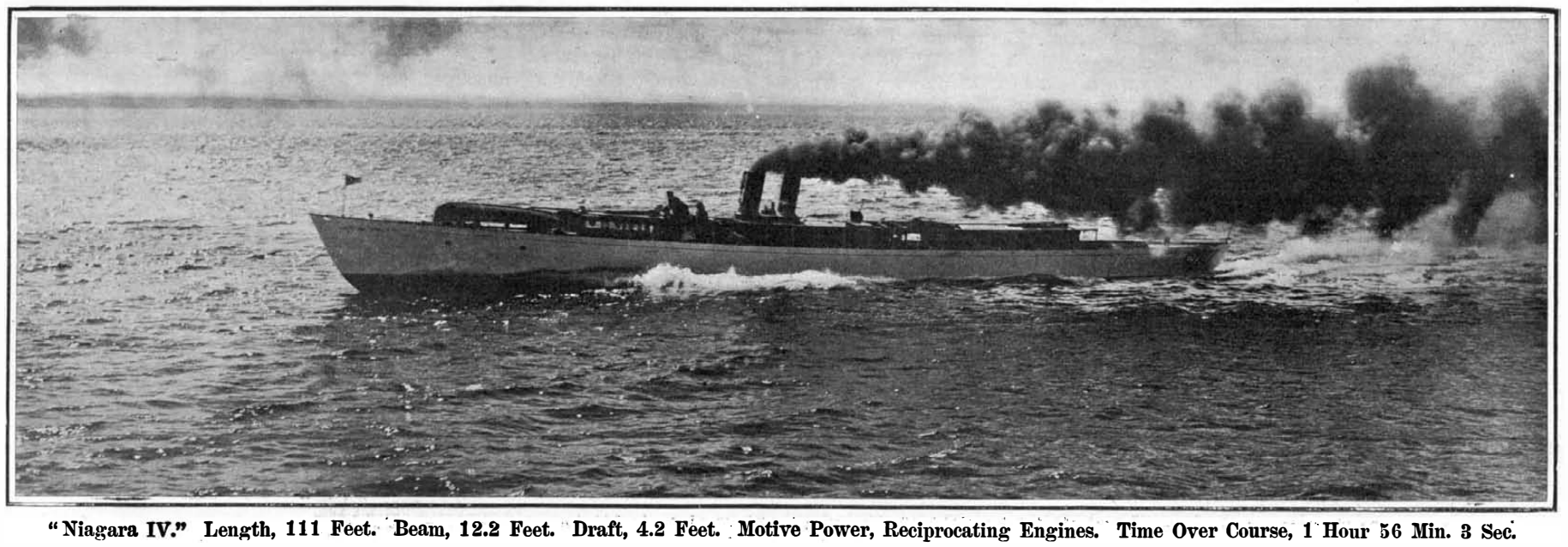
The 200-Horse-Power "Veritas," Which Maintained a Speed of 24.13 Knots (27.81 Miles an Hour) Over the Course of 10 Nautical Miles.

SOME WINNERS IN THE RECENT POWER-BOAT RACES ON THE HUDSON.

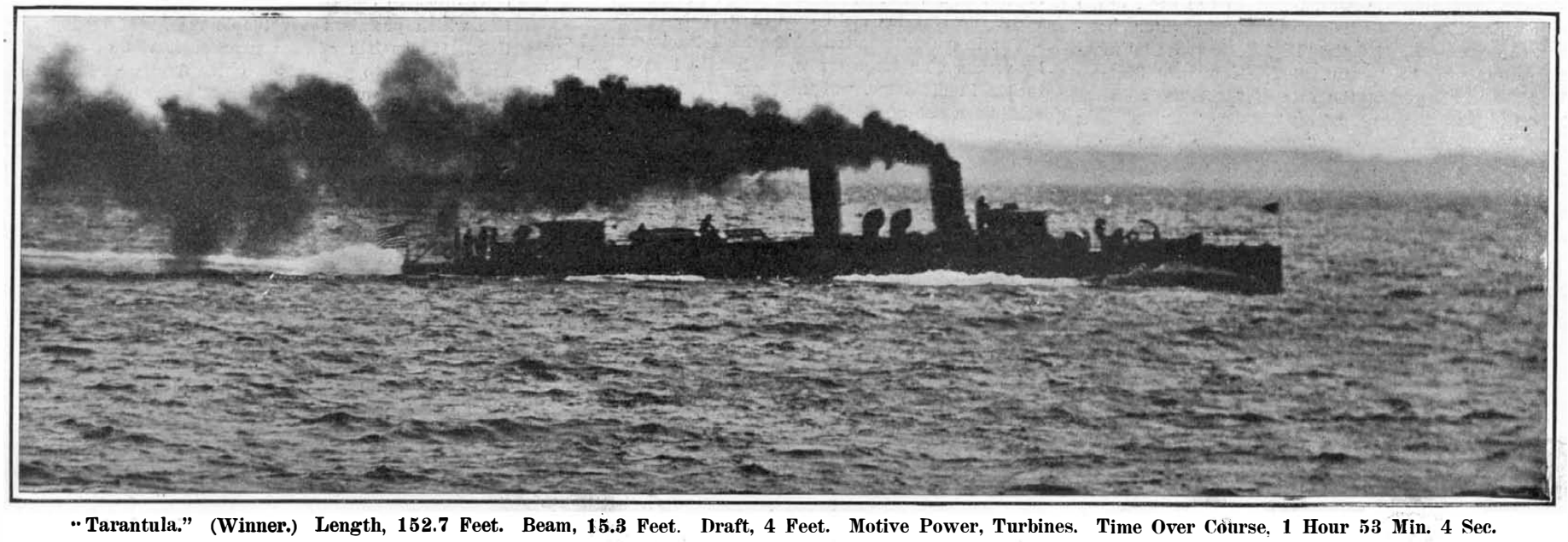
HIGH-SPEED STEAM YACHT AND POWER-BOAT RACES.

During last week there occurred in eastern waters a series of races between fast steam yachts and power boats which excited widespread attention. The steam yacht was represented in the private return match between W. K. Vanderbilt, Jr.'s, turbine vessel the "Tarantula," and Howard Gould's "Niagara IV.," which is driven by high-speed reciprocating engines. The power-boat races were held under the auspices of the National Association of Engine and Boat Manufacturers, and they were deemed of sufficient importance by the federal government to pass a special Act of Congress authorizing the policing of the Hudson River course with revenue cutters.

It will be remembered that the "Tarantula" and "Niagara IV." raced last year over a course 39 nautical miles in length, on Long Island Sound, and that the turbine-driven yacht was defeated. In this year's race,



"Niagara IV." Length, 111 Feet. Beam, 12.2 Feet. Draft, 4.2 Feet. Motive Power, Reciprocating Engines. Time Over Course, 1 Hour 56 Min. 3 Sec.



"Tarantula." (Winner.) Length, 152.7 Feet. Beam, 15.3 Feet. Draft, 4 Feet. Motive Power, Turbines. Time Over Course, 1 Hour 53 Min. 4 Sec.

FORTY-NAUTICAL-MILE RACE BETWEEN TURBINE AND RECIPROCATING ENGINE YACHTS.

however, the "Tarantula" turned the tables by beating the "Niagara IV." over a 40-knot course by 2 minutes 59 seconds official time, and 2 minutes 48 seconds actual time, both yachts being handicapped at the start. The "Tarantula," which is modeled on torpedo-boat lines, was built by Yarrow & Co., London. She is a steel vessel 152.7 feet in length, 15.3 feet in beam, with a draft of 4 feet. She is driven by Parsons turbines connected to three propeller shafts with a single propeller on each, and steam is supplied by two water-tube Mosher boilers. Her gross tonnage is 123.50. The "Niagara IV." is a much smaller vessel of 50 gross tons. She is 111 feet in length over all, 12.2 feet in beam, and draws 4.2 feet. She is a wooden vessel, built by the Gas Engine and Power Company, of Morris Heights, and she is driven by twin triple-expansion engines, steam being supplied by a water-tube boiler of the type made by the builders of the vessel.

The course of 20 nautical miles was laid out on Long Island Sound, and had to be covered twice. The yachts crossed the line at the start with "Tarantula" in the lead by 11 seconds, and she gradually began to increase her lead until, when the race had been under way for about 25 minutes, the "Tarantula" was 1-3 of a mile to the good. She rounded the outer stake five minutes ahead of the "Niagara IV.," having made the outward run of 20 miles at a speed of 25.12 statute miles an hour. On the return trip the "Niagara" did better work, but failed to cut down the lead of the "Tarantula," which finished with an advantage of 2 minutes and 59 seconds. If we disregard the handicap at the start, the speed of the "Tarantula" on the outward leg was 25.12 statute miles, and on the return trip 23.79 statute miles an hour.

The series of motor boat races was held upon the Hudson River over a triangular course, the apex of which was about opposite West 97th Street. There were two courses used. The longer one extended up the east side of the river to a point opposite Fort Washington Park, thence down the west shore to Weehawken, and back diagonally across the river to the starting point. It was 10 nautical miles in length. The shorter course, 6½ nautical miles in length, was within the longer one.

After several races for launches and cruisers, the chief race of the first day—that for 12-meter (39.37-foot) racers was started. This race was the first of three for an international trophy. Besides the "Dixie" and the "Shooting Star II.," which were the only boats to finish, two new boats to cross the starting line were Herreshoff's "Den" and the "Winton," a twelve-cylinder boat of 150 horse-power, whose hull was designed by B. B. Crowninshield and the motor of which was made up of three standard, four-cylinder automobile engines having 5¼ x 6-inch cylinders. Both of these boats quit almost at the start. The "Panhard II." had a close race with the "Shooting Star," which she distanced by about two boat-lengths. The "Dixie," steered by her owner, Mr. E. R. Thomas, passed both these boats at the first turn, and then the "Panhard II." withdrew after going only three-quarters of the distance around the course. The "Dixie" averaged in this race 19.6 nautical (22.59 statute) and the "Shooting Star" 18.09 nautical (20.85 statute) miles per hour.

The event of the second day was a long-distance race to Poughkeepsie and back, a distance of 134 miles. As the race was run as a handicap, and as the entries were numerous, it took three hours for all that were ready to be sent off. Those that started gradually dropped out from one cause or another, so that finally but two boats finished before sundown—the 30-horse-power "Simplex III.," in 7 hours, 27 minutes, 53 seconds, and the 30-horse-power "Wizard" in 7 hours, 58 minutes, 52 seconds. This figures out an average speed for the winner (which has a 4½ x 5½ four-cylinder S. & M. motor) of 17.95 miles per hour. The "Veritas," the highest-powered boat in the fleet, broke her clutch after the first day's racing, in which, however, she practically tied the "Dixie" for speed by making a circuit of the 10-nautical-mile course in 24 minutes, 52 seconds, or at the rate of 24.19 knots (27.81 statute miles per hour), as against the "Dixie's" best circuit in 24 minutes and 8 seconds, or 24.19 knots (27.82 statute miles an hour). The engine of the "Veritas" is a 7¾ x 9 eight-cylinder Craig. The only difference between this engine and that of the "Onontio" (which we illustrated in our March 4, 1905, issue) is that the "Veritas's" engine has auxiliary exhaust ports at the base of each cylinder. This huge engine speeds up as high as 825 R. P. M. and develops over 200 horse-power. The boat is 57 feet long over all; she has a 7-foot beam, and draws 18 inches of water.

One of the best races the first day was a handicap having four starters, and which was won by the "Durno," a small boat fitted with a 7-horse-power, two-cylinder, two-cycle Rochester motor. Given a handicap of over an hour, this boat beat the 30-horse-power "Simplex III." by 14 minutes, 53 seconds. She also won in the final for boats 33 feet long and under, and hence was awarded the Interstate trophy. This fine showing is to be accounted for, doubtless, by the fact that her owner, Mr. J. H. Durno, is one of our best experts on the screw propeller.

The last day of the races saw the "Dixie" twice again a winner. In the morning, in a 30-nautical mile race, she finished in 1 hour, 18 minutes, 15 seconds, which is equivalent to an average speed of 23.003 knots, or 26.453 statute miles an hour. In the afternoon, although the time for the total distance was not so good, the "Dixie" made the last circuit in 24 minutes, 8 seconds, which equals a speed of 24.19 knots, or 27.82 statute miles an hour.

In view of the fine showing made by the "Dixie," it will be interesting to note that she has an eight-cylinder S. & M. Simplex motor, having cylinders with a 6½-inch bore and a 6¾-inch stroke. This engine is rated at 150 horse-power at 800 R. P. M. The engine of the "Shooting Star II.," which boat came in second to the "Dixie" in the race the first day, is a 4½ x 5½ eight-cylinder Lozier rated at 51 horse-power at 890 R. P. M.; while that of the "Wizard," the only other boat besides the "Simplex III." to finish the Poughkeepsie race, is a 6 x 7 four-cylinder Buffalo motor rated at 30 horse-power at 600 R. P. M. The "Dixie" is the boat which was to have represented America in the second international race for the Harmsworth trophy. This race took place on September 11 over a 30-nautical-mile course in Arcachon Bay on the north coast of France. The two "Brookes" (English) and one French boat, the "Mab," failed to finish. The two "Napiers"—the "II." and "I."—won the race in the order mentioned in 1 hour, 32 minutes, 26 seconds, and 1 hour, 33 minutes, 52 seconds. The speed of the winner was but 19.44 knots, or less than 22½ miles an hour; so had the "Dixie" competed and performed as well as she did in this instance, she would have stood a good chance of winning.

The "XPDNC," the same boat with which the late Frank Croker made records a year ago, is now propelled by a 75-horse-power four-cylinder Mercedes engine of 6½-inch bore and 5½-inch stroke, and which develops its power at 1,100 R. P. M. She won all three heats for the National trophy, her best time for the 30-nautical-mile course being 1:24:01, which is equivalent to 21.41 knots, or 24.68 statute miles an hour.

The races demonstrated once more the extreme fragility and liability to break-down of the high-powered motor boat. Like the racing auto, these freaks now serve no useful purpose, but are constructed merely for the sake of sport and the satisfying of the craze for speed at whatever cost.

180-TON SHEAR LEGS FOR THE BRITISH NAVAL DOCKYARD.

The resources of the British naval dockyard at Chatham for the handling of heavy material, such as the lifting of the largest types of guns upon battleships, have recently been augmented by the erection of large shear legs capable of dealing with a maximum load of 180 tons. These shears, which have been constructed by Messrs. Day, Summers & Co., of the Northam Ironworks, Southampton, are the largest in the world, and are of massive proportions.

The legs are constructed upon the hollow spindle principle, which was first introduced by this firm in their early types of steam traversing shear legs. As will be seen from the accompanying illustration, there are three legs—two front and a single back leg. The two front members each measure 160 feet in length, while the rear leg is 210 feet from end to end. They are all constructed with tapered ends, both top and bottom. In the case of the front legs, the greatest diameter in the center is 5 feet, with a taper to 3 feet at each end. The rear leg has a central diameter of 6 feet, the taper also being to 3 feet at each end. The total weight of the three members alone is 141 tons, of which the two front legs each represent 44 tons, while the rear leg is 53 tons in weight.

The in-and-out motion of the back leg is carried out by means of a large screw, 85 feet in length by 11½ inches in diameter, weighing over 11 tons, and operated by a set of steam engines. The hoisting equipment comprises three winches, each of which is driven by its own set of steam engines. Two of these winches each have a lifting capacity of 90 tons. There is also an inhaul winch, which is driven by a separate engine. The steam is supplied by two boilers.

The front page illustration shows the legs undergoing the official trial after erection at the dockyard. A dead weight representing 180 tons was lifted simultaneously by the two hoisting winches with complete ease, the rate of hoisting of each winch with 90 tons of weight being over 10 feet per minute. The full test load of 180 tons was lifted from the dock, run out to the maximum overhang of 64 feet from the perpendicular, and brought inboard again with complete ease. By the addition of this plant to the dockyard, the hauling equipment is appreciably decreased, since by its aid the heaviest guns and so forth of a battleship moored beneath can be lifted clear of the deck of the vessel, swung inboard, and deposited upon the ground or onto transport wagons with the greatest facility in the minimum of time.

Messrs. Day, Summers & Co. were the original inventors of this type of handling plant, and their utility was conclusively demonstrated at Port Arthur during the present conflict between Russia and Japan. The equipment of the dockyard at Port Arthur included three sets of these shears, each with a lifting capacity of 60 tons. In this case the legs were employed for the purpose of facilitating temporary repairs to large battleships, which had suffered penetration of the hull from heavy guns, without necessitating drydocking operations. In these installations, below the shear poles the dock wall was covered by a staging similar to the lateral section of a graving dock. The battleship requiring overhauling was brought alongside this staging beneath the shear legs. The vessel was then heeled over by the plant until the damaged portions were exposed. The repairs were then quickly effected, the workmen having access to the defects in the hull from the staging. The Japanese turned one of these shears, which they captured uninjured, to excellent account for the salvaging and patching up of the vessels they secured more or less damaged in the harbor after its capitulation.

There are at the present time two sets of shears similar to those which we illustrate, only of 150 tons capacity, in course of construction for the British naval dockyard at Gibraltar by this firm. In this instance, however, the necessary motive power will be electricity instead of steam.

Death of Count di Brazza.

Count Pierre Savorgnan di Brazza died on September 14. To him France owes her African possessions in the Congo Free State.

Pierre Savorgnan di Brazza was born at Rio Janeiro in 1852, of a noble Italian family, the Counts di Brazza-Savorgnan, but was brought up in French schools, trained for the French navy, and his name, since he became famous, has usually been inverted into Pierre Savorgnan di Brazza.

Following immediately on Stanley's great journey down the Congo, Di Brazza between 1876 and 1878 explored the upper course of the River Ogowe, the chief stream of French Guinea, to its sources, and went beyond, following far streams that flowed into the Congo, and demonstrating that a practical route to that river existed along the line of his exploration.

In 1879 he succeeded in reaching the spot later called Brazzaville on Stanley Pool before Stanley worked his way up the Congo River. Di Brazza's appearance on the Congo hastened the agreement of the powers by which Africa was partitioned into "spheres of action."

In 1888, while still only a naval lieutenant, he was appointed commissary general of the French Congo and organized the whole administration of the colony In 1891 he was again appointed and remained in charge till 1897, when he again resigned on account of ill health.

His explorations were made with a simplicity of equipment that provoked Stanley's contempt. He was the sole white man in the party that Stanley met at Stanley Pool, and he had only a few semi-civilized coast negroes with him. His explorations were of the thorough, unrecognized kind that mark the heroic age of Congo discovery.

Savorgnan di Brazza was 53 years old when he died. He was a naval ensign at 24 years of age, when he made his first Ogowe journey; became governor of the colony at 33, and was only 39 when he entered on his second term.

A New Motor Roadway.

A roadway or track for motor-propelled vehicles has been invented recently by Dr. T. A. Johnson, of Xenia, Ill., which promises a valuable means of transportation. It consists of two parallel tracks of concrete formed so as to present an outer flange, and a broad treadway with a strengthening rib running down into the ballast, which has been rolled firmly in the ditches previously excavated. This roadway is designed for motor vehicles, both passenger and freight, the cars having rubber tires. The track can be used as a toll line for automobiles. The inventor has also a device which can be attached to the steering lugs of the vehicle, preventing contact of tires with flanges, and obviating steering by motorman.

A Decoration for Arthur von Briesen.

Mr. Arthur von Briesen, one of the foremost members of the American patent bar and an old member of the Scientific American staff, has received from the government of France the cross of the Legion of Honor for his splendid work as president of the Legal Aid Society, in which capacity he has for years labored to protect the poor of French and other nationalities from the injustice which their poverty prevents them from combating.

Correspondence.

To Prevent Drawbridge Accidents.

To the Editor of the SCIENTIFIC AMERICAN:

If the approach to the drawbridge in Norfolk had been protected by a derail, that sad accident would not have occurred which resulted in the death of eighty people. The derail could be so connected that when the draw swung off, it would open the derail and, at the same time, throw a semaphore signal to danger (also mechanically connected with the drawbridge), which, located at a proper distance away, would notify approaching trains the draw was open. In case a train disregarded this signal, the derail would let it off on to the ground, thus preventing what might be a bad accident.

F. H. SIDNEY.

Boston, Mass., August 30, 1905.

The Submarine Signal.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 9, on page 196, the last column, there was an article concerning submarine signaling, headed "An Improved Submarine Signal." We would like very much to correct the false impression which would be circulated by this article. The article as it stands contains facts which are perfectly true, except that this "fish" transmitter, as it is called, is an obsolete piece of apparatus which has not been in use by our company for a couple of years.

Mr. Mundy at that time was connected with the company, and in conjunction with the other engineers in this company at that time devised this "fish," the point being that the noise in the boat was so great that if the receiver were put in the boat itself it would drown the sound of the bell for which the hearers were listening. Improvements in the receiving apparatus have entirely overcome this and the fish has been discarded. It was an apparatus which possibly was a temporary help in overcoming a slight difficulty in the development of the system.

We hope that you can by this explanation clear up the impression which was created by your article.

SUBMARINE SIGNAL COMPANY.

Boston, September 16, 1905.

Chains Versus Cables on the Manhattan Bridge.

To the Editor of the SCIENTIFIC AMERICAN:

An editorial of September 9 makes a comparison between the new Elizabeth bridge at Buda-Pesth and the Manhattan bridge over the East River.

If the Buda-Pesth bridge represents the "advanced ideas of the leading bridge builders of the world," these ideas must necessarily refer only to the rocking towers as a novelty for large bridges, because, outside of this feature, the Buda-Pesth bridge is built on old and reliable principles, like many other suspension bridges, and represents no special new feature.

That the floor is suspended from eye-bar chains, in place of wire cables, is a revival of an old construction and, in an economic sense, decidedly a retrograde step. The stiffening construction of the Buda-Pesth bridge is precisely the same kind and of the same proportions as in the Manhattan bridge in its present design.

The claim that this design is inferior to the chain-cable bridge, designed under the former administration, may be a matter of opinion, but that it will cost $2,000,000 more than the latter is a decided error.

The abolishment of the tower hinges is mentioned as one point of inferiority, but many engineers believe that this fact will make the bridge superior, though they all agree that it will make the towers more expensive. The present engineers of the bridge consider the advantages of a tower without hinge, in gaining a precise knowledge of the stresses and in giving greater stability to the bridge, fully worth the money it costs more.

In regard to a hinge in the floor beam, the matter is reversed, viz., floor beams with hinges will be more expensive, but they admit of a more accurate determination of the stresses. This matter is, however, a detail of secondary importance and cannot be taken as a criterion for the quality of the bridge as a whole.

The statement that the Manhattan bridge, on its present design, is costing $2,000,000 more than a chain-cable bridge would have cost, can easily be refuted as an impossibility.

The breaking strength of steel wire is known to be three times greater than that of nickel-steel eye-bars, hence a chain made of the latter will, under existing conditions, weigh 4.84 times more than a wire cable of equal strength.

The total weight of the wire cables, as calculated by the lowest bidder for the Manhattan bridge, is 6,328 tons, hence the nickel-steel chain would weigh 30,827 tons and would cost $5,654,000 at 9.23 cents per pound, given by the same bidder as unit price for nickel-steel, including the temporary working bridges.

The bid for wire cables, however, is only $1,848,000, showing that the eye-bar chain would cost $3,806,000 more. To this sum must be added other sums for the increased cost of anchorages and anchor chains, foundations, etc., which would make the total cost of the chain bridge about $4,750,000 more.

Granting all the minor economic advantages claimed for the eye-bar design and making liberal allowances for them, it still follows from the above given figures that the Manhattan bridge, on its present design, will, instead of $2,000,000 more, at the very least, cost $4,000,000 less than the eye-bar bridge would have cost.

WILHELM HILDENBRAND.

New York, September 13, 1905.

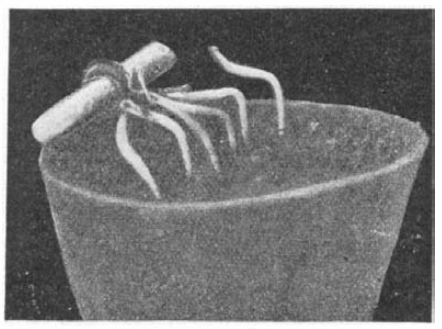
[That the chain cable is "old" is not disputed. The "advanced ideas" are those which are shown in the use of nickel-steel, the rigid attachment of the chains to the towers, the hinged footing of the towers, the hinged floor beams, and, in the Manhattan chain design, the trussing of the cables. We note that our correspondent admits that throwing out the hinged construction in the towers has incurred greater expense. In this connection it may be mentioned that the rejection of the hinged towers—a feature which the expert board had specially commended—has added 4,100 tons to the weight of the towers. This is 299 tons more than the total weight, 3,801 tons, of the whole suspended structure of the Buda-Pesth bridge. The question of the relative cost of the eye-bar and wire cable designs is discussed in our editorial columns.—EDITOR.]

HELIOTROPISM INDUCED BY RADIUM.

Most plants seek the light, and if it does not fall directly upon them, bend and grow toward it. This is called positive heliotropism, while the peculiarity of other plants, which avoid light, is known as negative heliotropism.

The question suggests itself whether this influence is exerted upon plants only by luminous rays or also by rays not perceptible by the eye. The question may be decided by the employment of radium, for the radium rays possess, of themselves, very little luminosity, while the phosphorescence of which they are the indirect cause is very bright.

Malisch (Berichte der Deutschen Botanischen Gesell-



HELIOTROPISM INDUCED BY RADIUM.

schaft, 1905, vol. 1) therefore exposed seedlings of various plants (lentils, peas, vetches) to radium rays. Not the slightest effect could be detected; but when the radium was mixed with zinc blende, which under these conditions becomes strongly phosphorescent, the seedlings turned and grew toward the light. The illustration shows, on the left, the little glass tube containing the mixture of radium and zinc blende. The seedlings have bent at right angles and are growing toward the tube.

Radium, therefore, exerts only an indirect heliotropic effect on plants.—Umschau.

Recent Long-Distance Trips with Electric Vehicles in France.

A most amusing comedy has just been enacted in connection with electric vehicle contests. It may be remembered that the Automobile Club de France originally intended to organize a trial for electric vehicles to consist of a run from Paris to Trouville—a distance of 130 miles—with a stop at Evreux for charging up. It was intended to run the competition in two days, the first day Paris to Evreux, and the second day Evreux to Trouville. For some reason or other this competition was never carried out, much to the regret of some of the manufacturers. In view of this the journal Les Sports organized a run from Paris to Trouville on behalf of M. Védrine, and we have already described this event. At the time M. Kriéger, the well-known manufacturer of electric carriages, was on his holiday, but as soon as he heard of it he posted back to Paris and with the assistance of the Auto organized a demonstration on his own account, which took place on September 1, and in which he covered the two stages of the journey in a much shorter time than Védrine, starting from Saint Germain with an electric cab carrying two passengers, and a landau carrying four passengers, at 6:02 for the cab and 6:07 for the landau, and arriving at Evreux, the cab at 7:53 and the landau at 7:59. At Evreux a stop was made for recharging, which was done in two hours and a half, and the vehicles set out again, the cab at 11:04 and the landau at 11:06, to arrive at Trouville at 1:23 and 1:34 respectively. The average, therefore, made by the two cars was over twenty-eight miles per hour for the cab and more than twenty-seven miles per hour for the landau, which established an undoubted record in the matter of speed.

While Kriéger was on his way from Saint Germain to Trouville he was quite unconscious that the rival journal, Les Sports, wanting to take the wind out of his sails, had secretly organized another contest for Védrine, who was to start after Kriéger and beat him, doing the same course with a covered cab in which were seated the driver, M. Van Lanker; M. Bary, engineer; M. Max Richard, the official timekeeper of the A. C. F., and Georges Prade, the editor of Les Sports. This vehicle started from Saint Germain just after the two Kriéger cars had left, and made the journey direct to Trouville without stopping to charge the batteries on the way. Although the average speed of Védrine's car was much less than that of the two Kriéger cars, he arrived in Trouville long before Kriéger, as, of course, he had not stopped to charge up. But the matter did not finish here, for Kriéger, on hearing of Védrine's performance, determined to make the return journey with two cars from Trouville to Saint Germain without stopping to charge up also. He accordingly started out on Friday, the cab at 9:05 and the landau at 9:08, and both cars arrived safely at Saint Germain at 2:03 and 2:19 respectively, beating Védrine's time by 1 hour 35 minutes, and constituting a veritable triumph, for not only did the Krieger cars succeed in covering the distance with one charge, but they then proceeded to the Place de la Concorde, made several calls in Paris and returned to the Kriéger garage with still a reserve of electricity in their batteries.—The Car.

Engineering Notes.

Lubricants are used not only to obviate friction, but to prevent heating of the wearing surfaces. It is best to employ tar-grease or tallow where there is considerable pressure with low velocity, fat and oil lubricants where there is lower pressure and higher velocity. For lubricating the cogs of toothed wheels we recommend green (barrel) soap mixed with filtered oil-dripping from the bearings, also mutton grease (in preference to pig's grease). For lubricating axles use Booth's axle lubricant, composed of ¼ kilogramme of soda dissolved in 4 liters of water, mixed with 1½ kilogrammes of tallow and 3 kilogrammes palm oil; the whole heated to 95 deg. C., and constantly stirred. With the addition of some sulphur, this mixture will be found an excellent preventive against heating of the wearing surfaces, especially with rapidly revolving pins. A little mineral oil (petroleum) may be added with advantage to vegetable or animal lubricants to prevent them from thickening or becoming resinous. Mineral oil has lately been almost universally employed in place of the above-mentioned somewhat expensive lubricants. It is sold in varying grades of purity under the name of spindle oil, cylinder oil, etc.—Der Metallarbeiter.

The following stages in the temperature of the wearing surfaces of parts of machinery are distinguished: 1. Cold; when the temperature of the parts is the same as that of the air. 2. Tepid; when the parts are sensibly hotter than the air, but can be touched by the hand without discomfort. 3. Warm; when they are painful to the touch, but there is as yet no disturbance in the working of the machinery. 4. Hot; when the wearing surfaces have suffered from the heat, and the bearings require regulating (unscrewing of the caps, cleaning of the oil-holes, polishing of the slides, etc.) before running smoothly. The "tepid" stage is always harmless if the temperature remains constant. If, however, it continues to rise, the ensuing "warm" stage must be promptly prevented to avoid danger. If thick oil is used, the friction is always greater when the machine is first started than later during the working; hence the axles will always be tepid, which, however, need not give rise to any anxiety. In fact, the friction diminishes as the heated oil or grease becomes more fluid. It should also be ascertained whether the heat of the machinery is not perhaps due to the rays of the sun or the neighborhood of furnaces, etc. The causes of the "hot" stage are: 1, careless lubricating; 2, screwing on the caps too tightly; 3, badly made wearing surfaces; 4, impurities, such as sand or dust, getting into the oil or grease; 5, stopping up of the oil conduits and bad distribution of the oil on the slides. The latter is very liable to occur on the slide of eccentric straps. If the heat is so great as to cause anxiety and cannot be diminished by lubricating, sprinkling with flowers of sulphur or water, etc., the machinery must be stopped and thoroughly overhauled. —Werkmeister Zeitung.

Death of Capt. Wiggins.

Capt. James Wiggins, the man who opened the northeastern passage, died on September 15. Capt. Wiggins made the first voyage through Kara Sea. He was a Fellow of the Royal Geographical Society and a life member of the Russian Imperial Geographical Society.

EVOLUTION OF THE CALIFORNIA CLAM-SHELL DREDGER.

BY H. A. CRAFTS.

The dredger is an important factor in California's industrial development, creating new harbors, making unnavigable streams navigable, and reclaiming thousands of acres of swamp and overflow lands to the uses of agriculture.

Of the two principal types the suction dredger is used in harbor work, while the clam-shell dredger is found to be especially adapted to river and reclamation work.

While the suction dredger is a rapid worker, it has been found to be unsuccessful for levee or embankment work, as it delivers the material in a highly diluted state, and this is then liable to slough off. The clam-shell dredger, however, brings up its loosened earth in almost solid form and may be made to place it in the exact spot desired. In this way the embankment may be built up solidly, as the work goes along, with no waste of labor or material.

It has been estimated that the original swamp and overflow lands of California, located principally in the Sacramento and San Joaquin valleys, aggregate not less than a million and a half acres. Part of this ground, delta lands, is subject to daily tidal overflow, some to freshet overflow, and some to both. As the State is taking active steps toward the permanent reclamation of great tracts of this land, it is expected that the clam-shell dredger will be more in demand than ever. Even at the present no less than fifty machines are in constant operation.

The old-style levee was for various reasons built close to the channel by the old "wheelbarrow and scraper" method. It was also narrow and was constructed with an abrupt slope, both inland and on the water front. Time proved that this was not a wise course to pursue. The wash caused by the passing steamers was much more effective in breaking down the embankment than if the slope had been more gradual. This manner of dike was also found less able to withstand the force of flood waters; so the conformation of the California levee has been greatly modified as the years have passed and with the evolution of the clam-shell dredger.

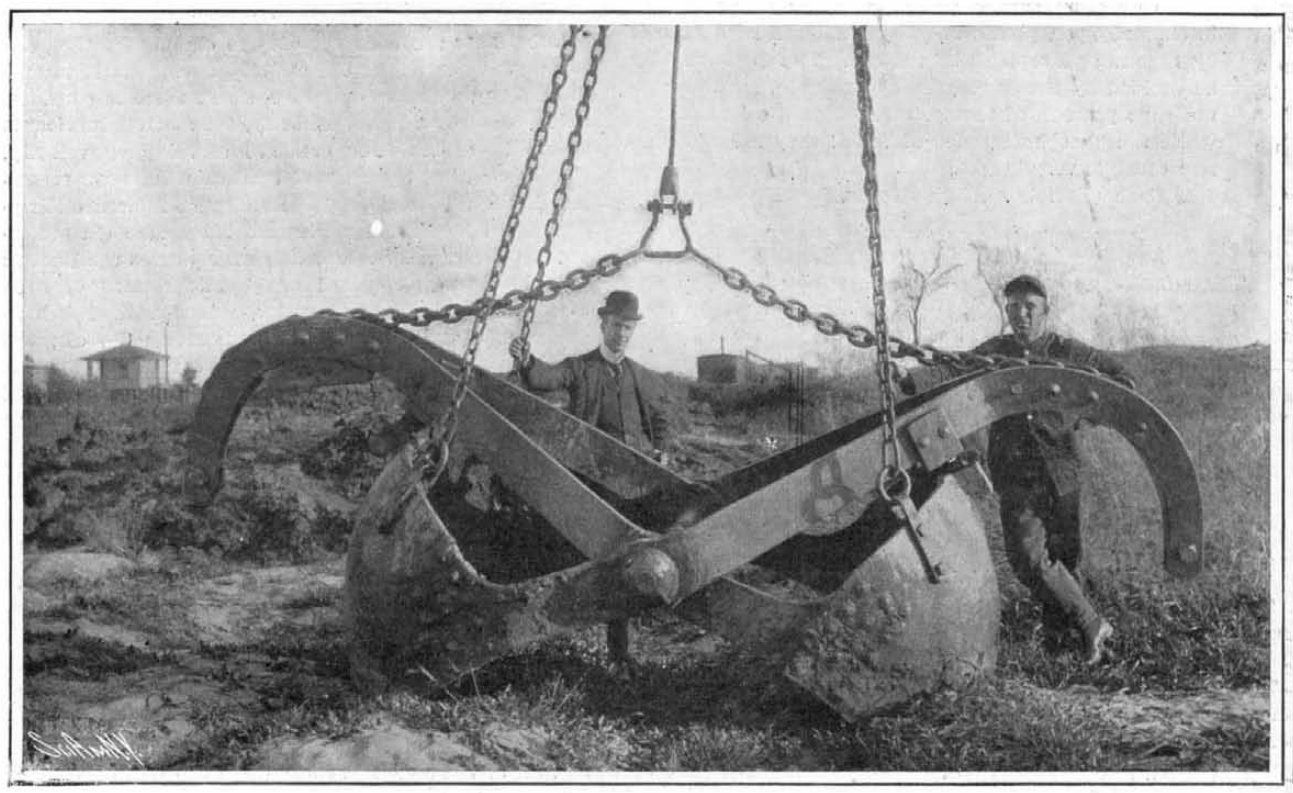
The old-style clam-shell dredger was known as the turn-table dredger. The turntable was secured to a mast, and was operated with a winding drum, the turntable having two projecting arms, which spanned the boom about one-fourth of the distance from the pivot. It was also operated by a chain lift to the bucket with a compound set of hoisting blocks. The present-day or new-style dredger is operated with steel wires, which lead directly from the winding drums to the end of the boom, thence to the bucket, connected direct, without any blocks. This gives a better control of the boom, the pull from the end giving an increased leverage.

The old-style clam-shell dredger had a single frame forward, with only one center back leg, while the new-style one has a double set of forward legs and two legs to stern corners of the hull, thereby preventing the stern of the hull from coming up during the process of lifting.

The buckets of the old clam-shell dredger were of plate steel, hammered to the shape of clam-shells, with forged iron arms. The bucket of the present-day dredger is made of cast steel, with forged-steel arms. The shapes have been made the subject of long and profound study, and have been so designed as to give the best results in digging in hard material. The bucket at present in use will take out material that the old-style bucket would make but little impression upon. It has a maximum holding capacity of eight cubic yards of material. A machine of this capacity will handle from 3,000 to 4,000 cubic yards in a day of twenty-four hours.

In the day of the old-style dredger the levees were still steep and close to the channels, so that the booms seldom exceeded 90 feet in length. To-day, however, with the gradually sloping embankment, the booms in use are 125 to 150 feet long.

One of the larger type, now building, is a machine that will be provided with three-yard buckets and operated by a 140-foot boom. Each of these machines costs from $45,000 to $55,000, according to the character of the equipment.



The New Clam-Shell Dredger Open.

The Dredger Closed.

THE MAKING OF A FELT HAT.

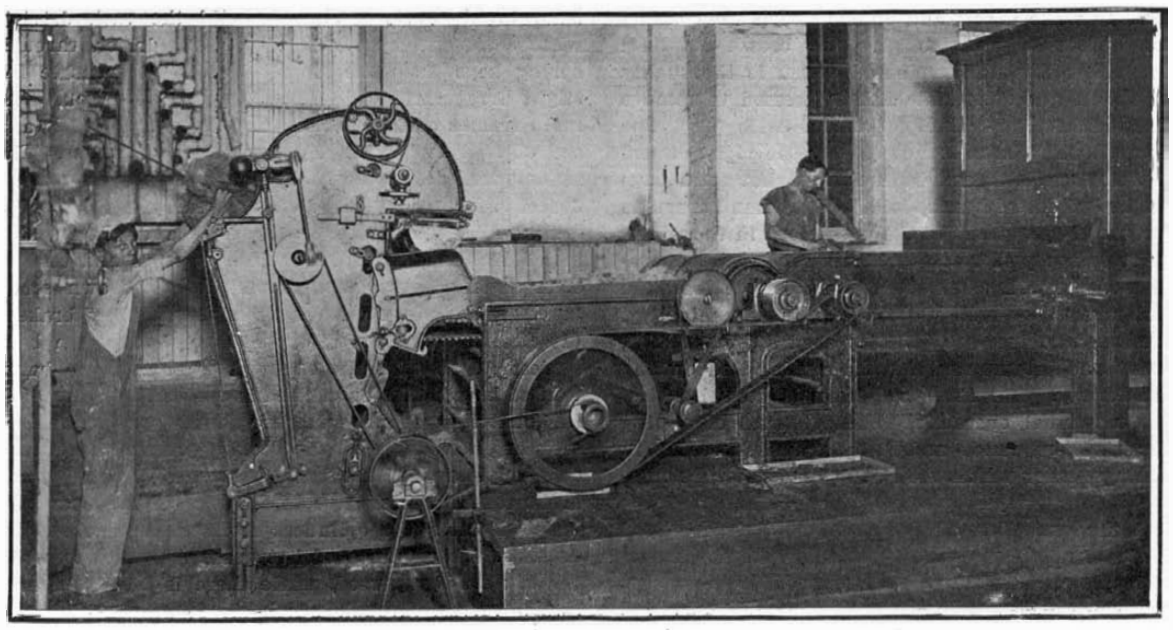
Generally speaking, felt is made from wool, hair, fur, or mixtures of these, by rolling, beating, and the application of pressure, often with the use of acid. The felting property of these substances is due to the fact that the fibers are rough in one direction only, for which reason they can glide among each other in such a way that, when the mass is agitated, the anterior extremities slide forward in advance of the body or posterior half of the hair and serve to entangle and compact the entire mass together. While considerable machinery has been invented and is used to a large extent in many felting processes, especially in the making of hats, skilled hand labor is still very commonly employed in many of the operations of the manufacture, though it must be admitted that the mechanical is constantly encroaching upon the territory of the manual, and it is now almost possible to make felt hats exclusively by machinery.

Many of the present-day uses of felt are beyond the scope of this article, which deals solely with the manufacture of felt hats—the ubiquitous derby and the tourist or Alpine hat. For this purpose, to-day, fur is almost exclusively used, the low price of this article almost entirely obviating the employment of wool even in the common and medium grades. Vegetable matter, with the exception of a little cotton thread or the backing for satin linings, has never been utilized in the manufacture. The furs most generally used are those of the coney, hare, nutria, muskrat, and beaver, in their various grades. The felting quality of the fur is affected by a number of considerations. That of newly-cut fur is inferior to that of fur which has been allowed to stand for some time. Acidulated water causes an increase in the shrinking power, while fatty substances have a contrary effect. The season of the year in which the animal is killed is also an important factor. The initial preparation of the furs for felting purposes is often a separate industry carried on by the so-called hatters' fur cutters, who deliver the prepared fur to the hat manufacturers, sometimes already mixed and blended, according to the quality of the hat required. The preparatory processes include washing and removing projecting hairs by plucking or shearing. The fur then undergoes a process called "carroting," an artificial method of increasing the felting property by chemical means, nitrate of mercury being utilized to roughen the fiber and raise the points of the scales. In the manufacture of hats a mixture of two parts of carroted to one of uncarroted fur is usually employed. After the carroting and a subsequent drying process the fur is cut from the pelt by machinery, the pelt being at the same time sliced into strips and used in the manufacture of glue and gelatine.

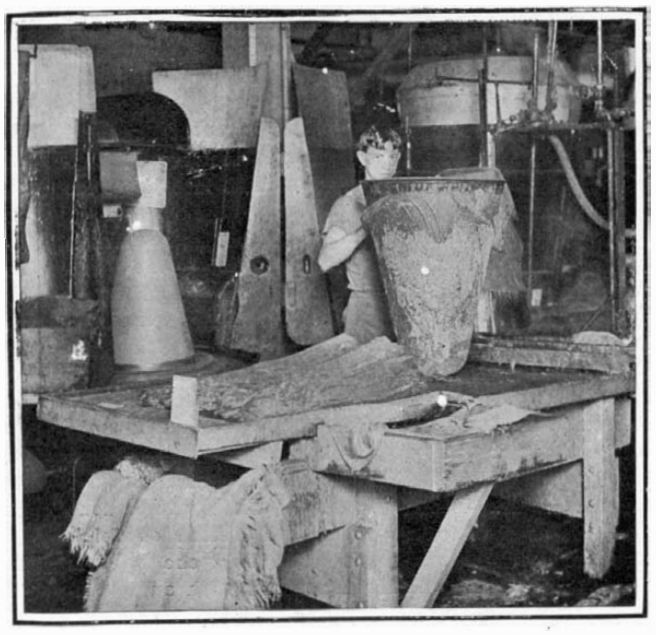
The first step in the hat factory proper is to further cleanse the fur by the removal of all foreign substances, including stray hairs, which the preceding processes have failed to eliminate. To accomplish this the material is passed through two machines, called the devil and the blowing-machine. The former consists of a cone-shaped casing studded interiorly with large teeth and a cone revolving inside of the casing, with teeth moving between the teeth of the latter. The larger end of the inner cone is provided with fan-blades which cause a current of air to pass through the machine, drawing the material with it. The fleeces, which have first been thoroughly stirred up by hand, are separated, fluffed, and the fur mingled and prepared for the blower by this operation. The blowing-machine consists of a number of sections, each of which is provided with a moving apron carrying the fur between two rollers. A picker revolving at a high rate of speed is located beyond the rolls and this tosses and fluffs the fur, the lighter particles falling upon the moving apron of the succeeding section, while the heavier impurities drop through a space between the picker and the apron. After passing through the blowing-machine the fur is ready for the next step, called "forming."

The forming machine consists essentially of a casing inclosing a revolving turntable carrying a perforated copper cone about a yard high. The machine is provided with proper feed apparatus, including an oil-cloth apron, feed-rolls, a picker, and a feed-drum. A powerful exhaust fan creates a strong suction, so that the fur is drawn from the drum and quickly and evenly covers the cone, through the perforations of which the air passes. The finer, lighter particles collect near the top of the felt body—later the crown of the hat—while the heavier, poorer fibers settle lower. A quantity of fur sufficient for one hat has first been weighed out, and when this is all on the cone the latter is covered with wet cloths and immersed in hot water for about one minute. The body is then stripped from the cone and undergoes the next or hardening process. In this, a workman first examines the body for imperfections to be removed or for weak places to be strengthened by the addition of a small quantity of fur, and then wraps about a dozen of the bodies in a woolen cloth, and rolling them by hand, gives them the initial hardening. This gives the body sufficient strength to allow handling with safety.

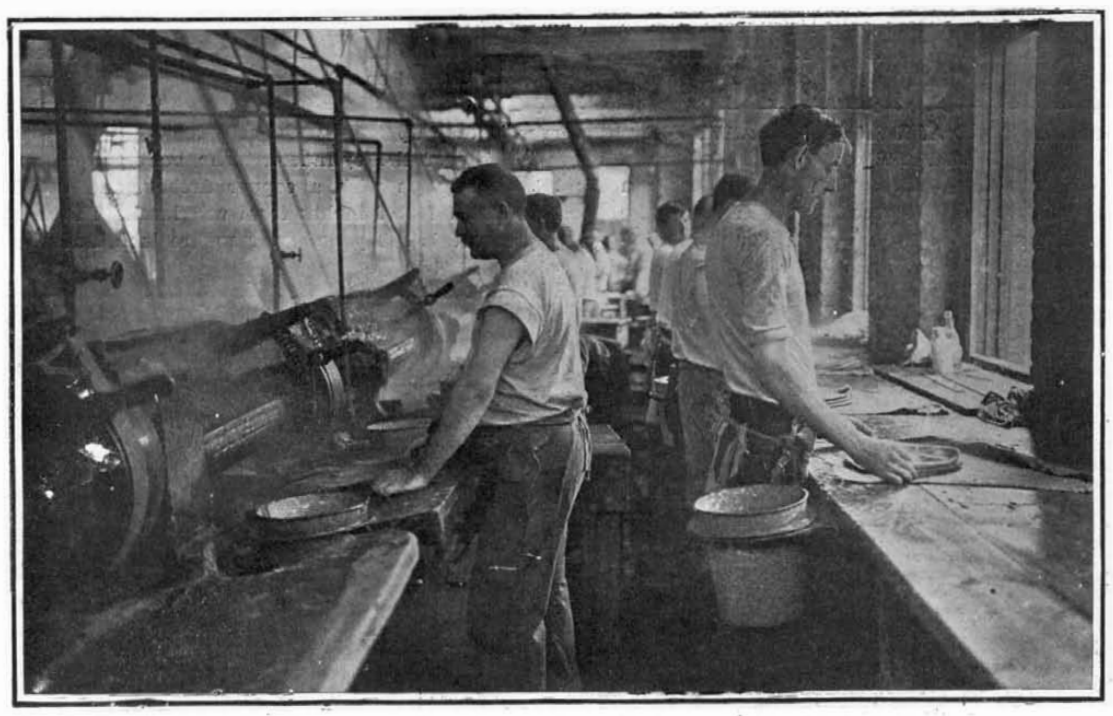
The succeeding step is called "first-sizing," and is the beginning of the felting proper. During this process the long, loose, cone-shaped body shrinks to a compact, closely-felted fabric of about one-third its original dimensions. During first-sizing the bodies are carefully and repeatedly inspected for imperfections or impurities, and the creases smoothed out. Sizing is simply a system of machine and hand rolling of the bodies, alternating with immersions in hot water. Naturally the rolling must at first be gentle, but as the fabric becomes stronger the work may be done more rapidly and with greater pressure. The bodies are usually first-sized three at a time, wrapped in bur-



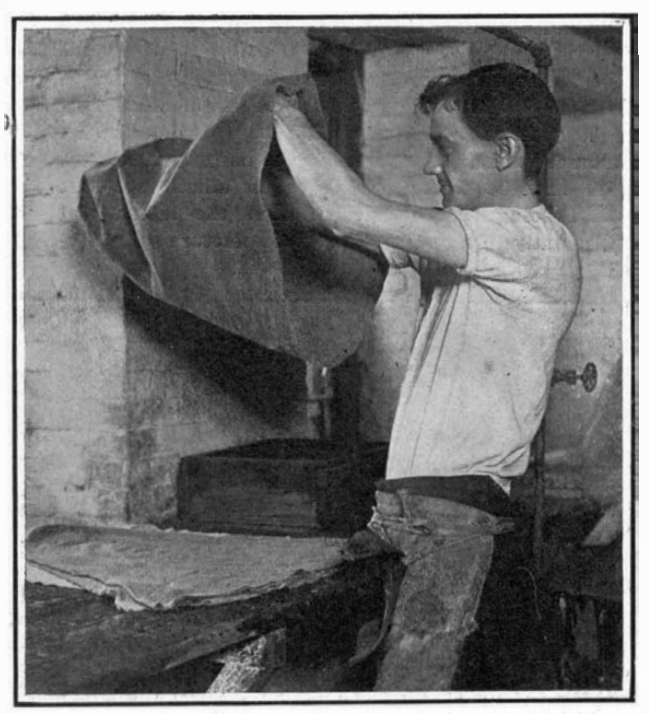
The Blower, by Which the Fur is Prepared and Cleaned for the Forming Machine.



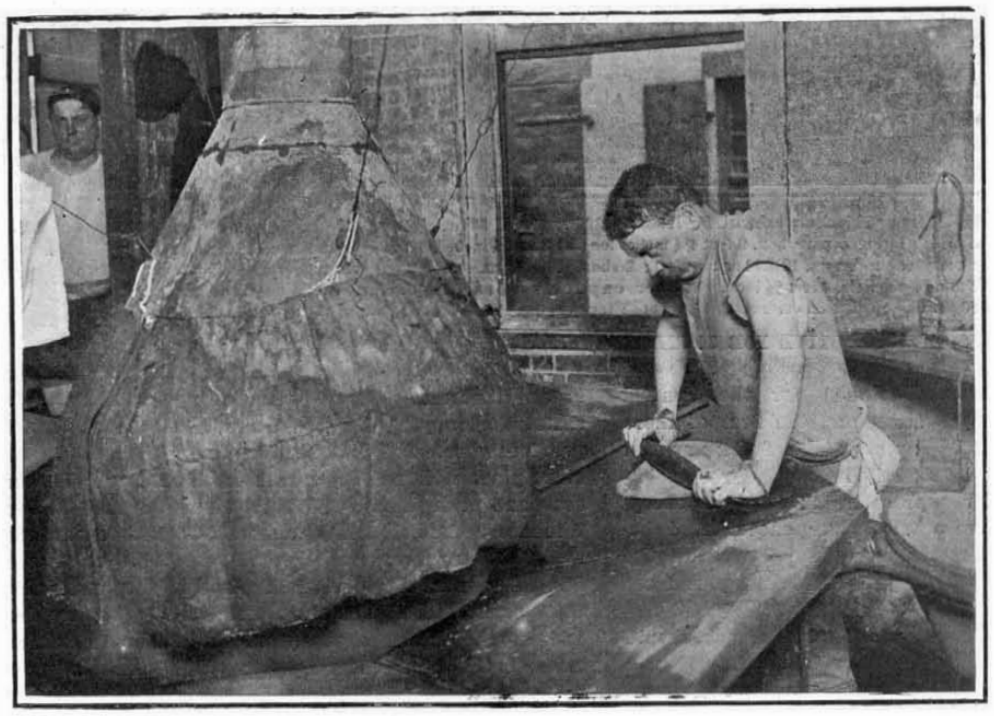
Stripping Body from the Cone After Forming.



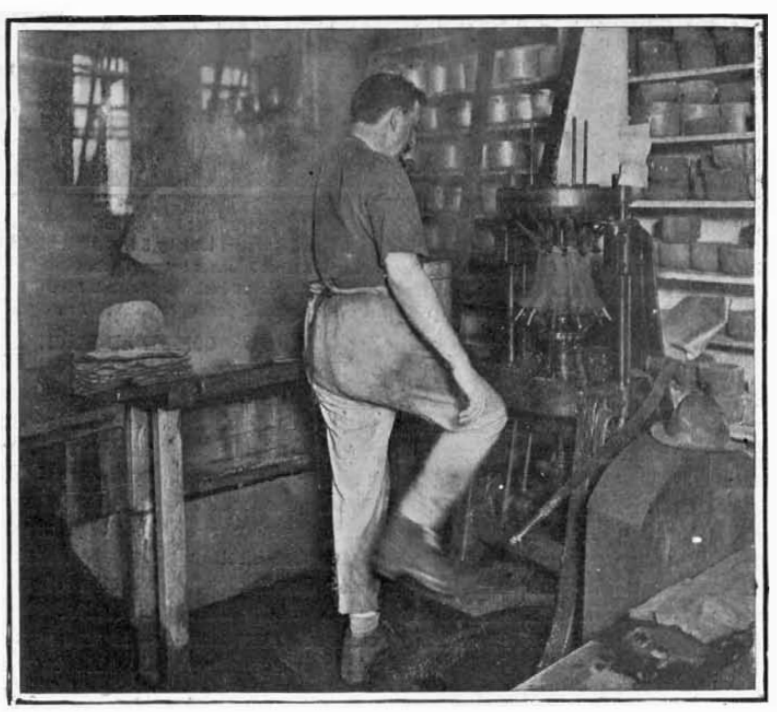
First-sizing. In This Operation the Felted Body Receives Its First Shrinking.



Looking for Imperfections in the Body Prior to Hardening.

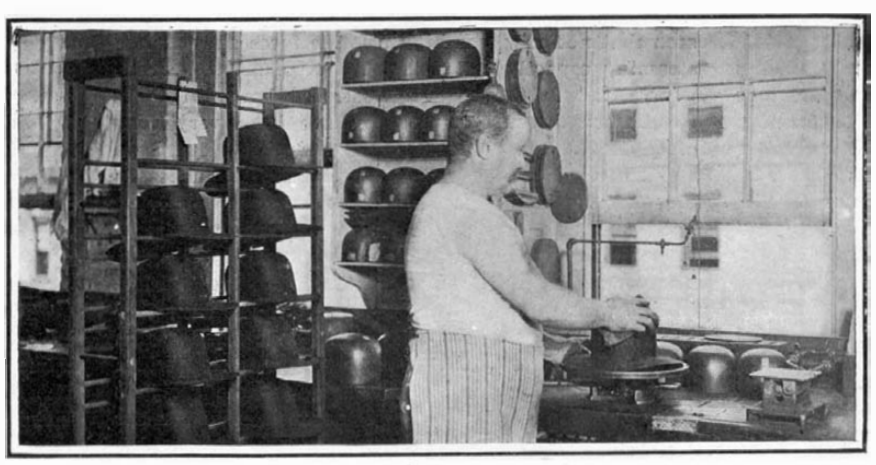


Second-Sizing. Using a Rolling-Pin to Shrink the Body Further.



Stretching the Crown and Brim—One of the Shaping Processes.

Finishing the Crown in the Hydraulic Press Which Gives It the Final Shape.



Crown-Finishing. Polishing the Hat After It is Pounced with Fine Sandpaper.

Curling the Brim to Give It the Proper Shape.

THE MAKING OF A FELT HAT.

lap. The machines used are comparatively simple and consist substantially of a pair of rolls of more or less irregular surface. During the sizing operation the fibers are bent by the rolling and spring back when the pressure is relaxed, thus creeping root foremost and entwining around each other in inextricable confusion, and compacting the entire mass into the close felt fabric.

The next operation is shaving the bodies to remove the protruding hairs which, notwithstanding the previous cleansing processes, sometimes remain in the fur. This was formerly done by hand, but to-day a machine in which a knife, moving back and forth with great rapidity, is passed over the surface of the body, is usually employed. After the shaving the body is ready for the so-called second-sizing, which still more compacts the felt, as the shaving has left it more open and porous and consequently prepared for further shrinkage. The second-sizing and pinning-out is done by hand at so-called batteries, but instead of doing three at a time wrapped in cloth, only one body is manipulated, being rolled on a board with an instrument not unlike an ordinary rolling-pin. The battery is a large tub surrounded octagonally by planks sloping slightly inward, and filled with water kept hot by condensed steam. Eight men usually work at one battery.

When the moisture has been thoroughly removed from the felt at the completion of the second-sizing the body is ready for the stiffening. The stiffening substance is shellac conveyed to the body by a solvent, which may be either alcohol or an alkali, the first method being more expensive than the latter, and consequently confined to the manufacture of high-priced hats. The body is repeatedly dipped in the solution and passed between rollers to force the stiffening substance into the fibers, and when the body is sufficiently impregnated the solvent is either evaporated or neutralized by a dilute acid. When the bodies are thoroughly dried they are placed in a metal chest and live steam is admitted. This liquefies the shellac which, by capillary attraction, is partially drawn from the surface into the interior of the fabric. After that operation the stiffener is entirely cleared from the surface by quickly dipping the body into a hot alkaline solution and then allowing it to remain for a period in tepid water. Great care must be exercised during the stiffening, as poor workmanship or inferior materials may cause the manufacturer great loss.

After the stiffening process is completed the hats undergo various shaping and stretching operations in machines which give them their initial forming and prepare them for the hand-blocking. The latter operation is performed at batteries similar to those in use during the sizings, and consists in immersing the hat in boiling water and shaping it by hand over a wooden or metal block of suitable form. This, of course, affects only the crown. The hats are now dyed in the usual manner common to many industries. While vegetable coloring matter was formerly used exclusively, the introduction of the aniline dyes was eagerly welcomed by the hat manufacturer, who at once recognized their value, and to-day they are used to the exclusion of all others. After the hat is dyed it is again hand-blocked, and then it is allowed to dry out thoroughly before undergoing the next or finishing operation.

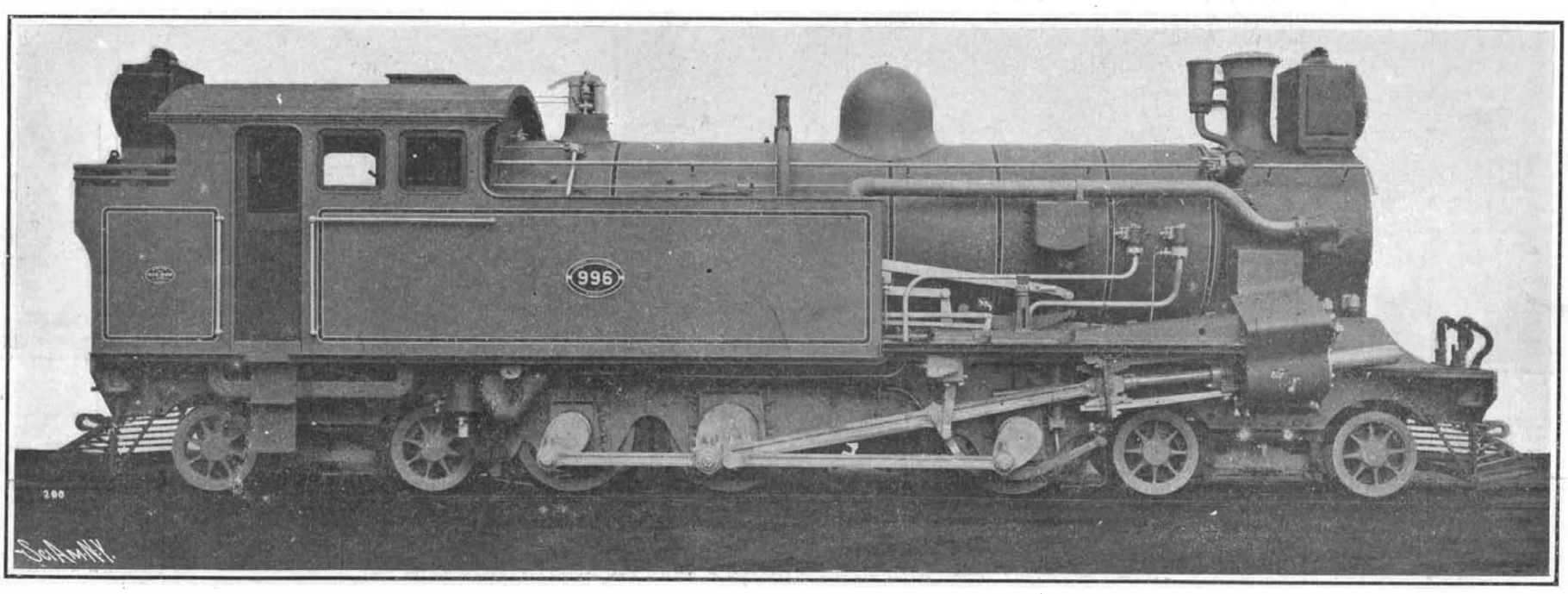
To finish the hat, it is placed in an iron case and steamed to make it soft and pliable and is then placed in an hydraulic press to give the crown its final shape. After this the condensed steam is thoroughly dried out in gas ovens, the hat is pressed to remove all inequalities, and finally pounced with very fine sand-paper. The brim is now cut to the right dimensions and then, softened by means of hot sand bags and a heated metal bench, is curled by hand irons to the proper shape. Most of the operations in the finishing process are performed by hand, but here, too, machine work is being introduced, and before long the manual operations will probably be in the minority. At present, machines are partially used for the ironing of brims and crowns and for the cutting and curling of the former. The final trimming is done by girls and is a manual operation. This consists of sewing on the bindings, bands and leathers and fastening in the linings, after which the hat is ready for the market.

With the exception of the amount of shellac used in the stiffening process, the procedure in the manufacture of soft felt hats differs very little from that of the derby. However, before being finished the tourist hats undergo a separate pouncing process, an additional step which is a distinct branch of the business, performed by operators called pouncers. The soft hat finisher does very little pouncing, in fact just enough to surface the felt.

COMBINED RACK AND ADHESION LOCOMOTIVE FOR SOUTH AFRICA.

In the accompanying photograph we illustrate a unique type of powerful locomotive which has quite recently been completed by the Vulcan Foundry, Limited (Newton-le-Willows, England) for the Central South African Railway system, and the first of these engines, the largest and most powerful of their special type ever built, is to be shortly introduced for assisting the heavy corridor express trains over the exceptionally severe gradients which are encountered between Waterval Onder and Waterval Boven on the stretch of railway separating Laurenco-Marques from Pretoria.

It was required of these locomotives that they should be able to assist, with an adhesion engine in front, a train of 350 tons over a 1-in-20 gradient for a distance of about 3½ miles, and that they should condense their own exhaust steam while passing through a tunnel situated at the top of the incline. It will thus be seen that not only was high tractive force and efficient steaming capacity called for, but also effective brake power, and in the engine illustrated herewith these requirements would appear to have been very completely met. The engines, it may be pointed out, have two entirely distinct pairs of cylinders, 18 inches in diameter by 20 inches stroke, the inner pair driving a coupled pair of cog wheels, carried upon a frame suspended from the leading and driving coupled axles. The connecting rods of the inside engine are connected to projections of the coupling rods of the rack gear and not directly to the crank pins—a method which has been rendered necessary by the restricted width available between the tires. The rack axle bearings are adjustable vertically so as to compensate for the wear of the adhesion wheel tires, and for this reason also the teeth are of involute form, so as to insure correct action between the adjustments. The cranks are of the disk type, having triangular circumferential grooves in which the cast-iron blocks of a hand-power band brake work. The teeth of the rack driving wheels are cut from steel rings and driven through spring keys from the axles so as to compensate for slight irregularities in the pitch of the rack. The main frames of the engine are outside the wheels and are of cast-steel plate, 1¼ inches in thickness. The six-coupled wheels driven by the outside cylinders are 3 feet 6 inches in diameter and carry a load of 45 tons, while the bogie wheels have a diameter of 2 feet 6 inches. The valve motion is Joy's and that of each engine is separately reversed by its own screw gear. There are no fewer than five distinct brakes: (1) Steam brake on all coupled wheels and on both bogies; (2) hand brake on coupled wheels; (3) hand-worked band brake on crank disks of rack engine; (4) Le Chatelier counter-pressure brake on pistons of rack engines, and (5) the counter-pressure air brake on the pistons of the rack engine. This last-named brake consists of a valve in the base of the blast pipe which isolates the cylinders from the smokebox and prevents the entrance of hot gases and cinders when the motion is reversed, while there is a pair of non-return valves, through which air is drawn from outside the smokebox into the exhaust ports and thence compressed into the steam pipe. A graduating discharge valve is fitted and through this the compressed air is allowed to escape into the atmosphere through a silencer carried on the chimney, while a small water jet delivers a cold spray into the exhaust space, which serves to take up the heat of compression and prevent overheating of the cylinders. The boiler is built of mild steel plates with a copper firebox, and has its center line 7 feet 6 inches from rail level. The working pressure is 200 pounds per square inch, and there is an abnormally large water capacity in order to assist the supply of steam through the short tunnel, previously referred to, in traveling through which the blast pipes will not be working. There are 197 charcoal and iron tubes, 2 inches diameter and 12 feet 7 inches in length, while the heating surface amounts to 1,438.33 square feet, to which the tubes contribute 1,298.13 square feet and the firebox the remaining 140.2 square feet. The grate area is 33½ square feet and the combined capacity of the side and bunker tanks is 1,200 gallons of water, while there is space provided for 50 hundredweight of coal. In addition to the engine brakes, the locomotives are fitted with a combination ejector and pipes for working the vacuum brakes of the train, when necessary. The engines, when empty, weigh 70½ tons, and, in running order, 84½ tons, and in appearance conform largely with the other powerful types of locomotives built for the Central South African Railways by the Vulcan Foundry, Limited, with as many parts as possible of which the rack and adhesion engines have been designed to interchange.



Cylinders: 2 outside adhesion; 2 inside rack; diameter, 18 inches; stroke, 20 inches; steam ports, 1⅜ inches by 16 inches; exhaust, 2½ inches by 16 inches. **Boiler:** Barrel, 12 feet 2⅝ inches long; diameter outside, 5 feet 1⅜ inch. **Firebox:** Outside shell, 10 feet 3⅛ inches long by 5 feet 4 inches, 4 feet 3 inches wide; inside copper box, 9 feet 4⅛ inches long by 3 feet 9 inches, 3 feet 6⅜ inches wide; height, 4 feet 7¼ inches. **Tubes:** No. 197; diameter, 2 inches; length, 12 feet 7 inches between tube plates. **Heating surface:** Tubes, 1298.13 square feet; firebox, 140.2 square feet; total, 1438.33 square feet. **Area of fire grate,** 33.5 square feet. **Wheels:** Bogie, 2 feet 6 inches; coupled, 3 feet 6¼ inches; rack on pitch circle, 3 feet 3⅜ inch. **Water capacity of tanks,** 1,200 gallons. Coal space for 2½ tons. **Working pressure,** 200 pounds per square inch. **Tractive force,** 80 per cent; adhesion engine, 22,085 pounds; rack engine, 25,636 pounds; total, 47,721 pounds.

COMBINED RACK AND ADHESION LOCOMOTIVE FOR SOUTH AFRICA.

Preparation of Caoutchouc in Africa.

The French administration in western Africa has undertaken the improvement of the quality of caoutchouc by initiating the natives in suitable methods. The adulteration of caoutchouc is entirely forbidden. Incisions in the rubber trees and plants are prohibited, except under limitations prescribed, and they are entirely forbidden during those months when the sap is rising. Professional schools are to be established, where the best processes for the harvesting and coagulation of the caoutchouc will be taught.

LITTLEFIELD AND THE ARTIFICIAL CREATION OF LIFE.

BY CHARLES EDWARD TINGLEY.

Succeeding the experiments of Loeb and prior to those of Burke were those announced by Dr. Charles Littlefield, but since the claims of the latter were so exceedingly broad and the methods employed so very loose the scientific world has paid very little attention to them. Nevertheless, a widespread interest has been created in the man and his work by the popular press, for the subject is one which appeals no less strongly to the lay than to the technically-trained mind. For this reason a critical review of his experiments may not be ill-timed.

What lends a glamor to the researches of this biologist is the fact that he cherishes the illusion of having actually produced not only the simple organic cell, but also a much higher and more complex form of life. The method by which he has generated supposed life in a sterile soil he does not seek to conceal, but instead gives a clear and connected account of it as well as of the theory upon which it rests, and though one may well find fault with the first, certainly no objection can be raised to the second.

The following instructions and description of the operation have been given by Dr. Littlefield by which the micro-organisms are supposed to be produced. The supplies are of the simplest kind and can be obtained in any drug store. These comprise a large but shallow glass vessel, having a capacity of one quart, several smaller glass dishes, a bell jar sufficiently large to inclose these receptacles, and finally, a good high-power microscope. The chemicals used are sodium chloride, or common table salt, alcohol, ammonia, and distilled water. In the larger vessel 2 ounces of the salt is dissolved in 6 ounces of the water, and when this is done 6 ounces of 90 per cent pure alcohol is added.

A portion of the solution thus formed is poured out of the larger into the smaller dishes, when 2 ounces of official aqua ammonia is stirred in with a clean glass rod, and the bell jar is then placed over them. A chemical reaction is set up and in the course of a few minutes bubbles of hydrogen will begin to form on the surface of the fluid, and a closer observation will show these little spheres to be gyrating with high velocity. In the course of half an hour the bubbles will cease to form; the liquid is then ready for the crucial test. With the microscope at hand and previously focused so that a globule of the unstable solution may be quickly observed, a very small portion is transferred from the dish to the glass slide, where the latter is adjusted on the stage and a magnified view is had. On examination detached particles of matter are seen moving through the medium from the center to the circumference with extreme rapidity, and continued investigation indicates other changes the liquid is undergoing. Crystals begin to appear, and those first formed are the characteristic transparent cubes of sodium chloride, and hence these are incapable of further development. After these, other crystals follow, and some assume a hexagonal form on the surface of the saturated solution, and it is from these latter minute six-sided bodies that the growth of the elementary organisms is said to take place.

The point is now reached, according to Dr. Littlefield, where the intangible force we know as life joins the lifeless matter, as current electricity energizes a coil of wire, and a microscopic organism possessing what Herbert Spencer defines as the "co-ordination of actions" begins its existence, which consists of a series of definite and successive changes, both in structure and composition, which take place within itself and without destroying its identity.

The growth of this supposed rudimentary vital element next follows in sequence, and as it is metamorphosed from the hexagonal crystal into a free, smooth, disk-shaped cell, we are informed that it bears a close resemblance to a red-blood corpuscle. The cellular disk now gradually expands in a direction at right angles to its surfaces and an ovoid form results from which pseudopodia or temporary extensions protrude similar to the amœba, and which in the latter are designed to take in food, for locomotion, etc.

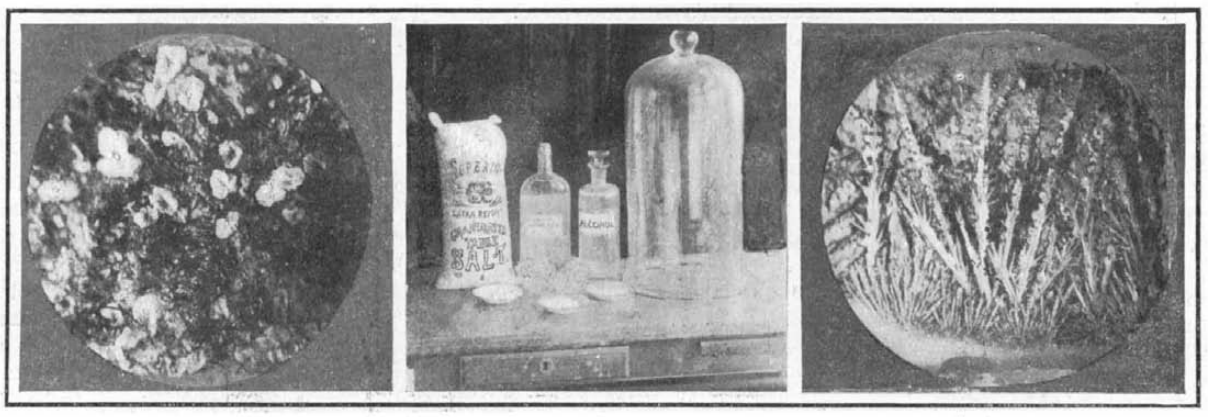
In commenting on his achievements, the doctor says: "I have carefully watched the development of a large number of these cells or germs, and they do not vary in the least detail as to their growth from the above description, showing unmistakable design and the actuality of life's processes. Moreover, mineral substances do not change except by accretions from without, and then not always in regular form and order. From the result of my experiments I am forced to conclude that there are two factors responsible for the manifestation known as life; one is a force or influence due to certain vibrations of the ether; and the other is a certain combination of atoms so arranged as to be capable of responding to these impressed vibrations. As an illustration, they act somewhat as the rods and cones of the optic nerve in the retina of the eye, which are so constituted that they may receive and focus certain vibrations of the luminiferous ether, giving us the phenomena of light and the sensation of sight. So there are combinations in nature so constituted and arranged in their atomic structure as to arrest the vibrations which act as electro-magnetic manifestations of a higher order than those of light, and these give us the phenomena of physical life, and the physical basis of this compound is salt, ammonia, and water in the presence of hydrogen, easily obtainable from alcohol, which is made up largely of this gas." Dr. Littlefield goes much further, and carries his huge claims to the startling extent of affirming that he has produced a full-fledged insect which, though invisible to the naked eye, under the microscope became an entomological object the like of which has never been seen before. "It resembled an elongated house-fly" (to quote the doctor again) "having two antennæ protruding from its head, while from its body grew six attenuated legs, the two nearest its head being of the comparative form and length of a grasshopper, while its transparent wings were covered with light-colored hair. This new insect is the outcome of thousands of experiments, and it has no counterpart in the textbooks dealing with that branch of zoology."

It is a far cry from a simple protoplasmic cell to that of a highly organized insect such as that just described, in fact almost as far as it is from lifeless crystals to living matter. Oppositely, the higher critics will have none of it, basing their conclusions on practically the same grounds that Prof. Tyndall took in relation to Dr. C. Henry Bastian's experiments nearly thirty-five years ago. This scientist, it would seem, was eminently qualified to investigate the origin of life, for he was recognized as an authority on biology and the pathology of the nervous system, and he was a strong advocate of the doctrine of spontaneous generation of life. In one of his many papers he pointed out the results he had obtained in creating life artificially, and he declared that "observation and experiment unmistakably testified that living matter is constantly being formed *de novo* and in accordance with the same laws and tendencies which determine all the more simple chemical combinations." Prof. Tyndall took up the matter and carefully tested Dr. Bastian's experiments, but took precautions, which the latter had neglected, to prevent the ingress of life during the processes of sealing the vessels, and though he varied the experiment in many ways no germs of life manifested themselves, so that Tyndall felt impelled to thus testify: "I affirm that no shred of trustworthy evidence exists to prove that life in our day has ever appeared independent of antecedent life."

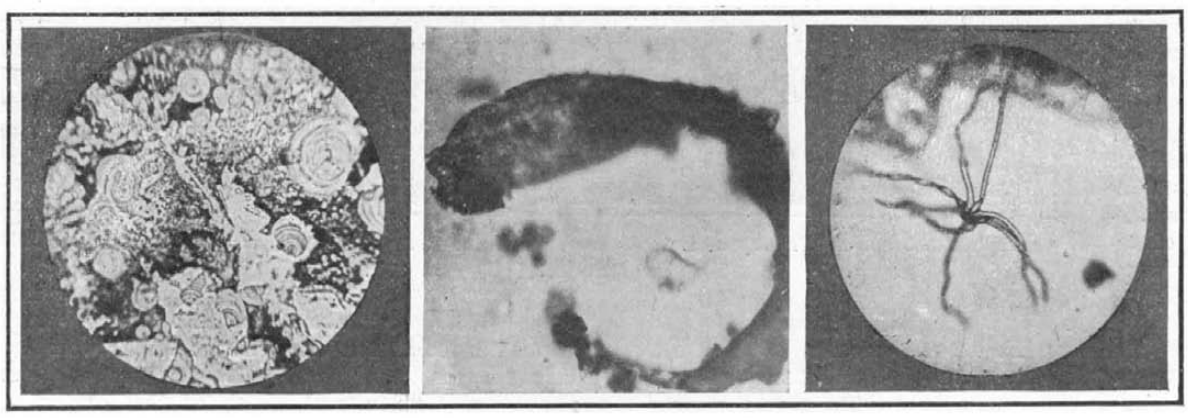
The moral of Tyndall's statement is obvious; the value of Dr. Littlefield's or any one else's experiments in the artificial generation of life lies absolutely and solely on excluding every trace of pre-existing life and thus preventing contamination which must otherwise surely follow during the progress of the tests. Carelessness in this respect has led biologists, even those who believe in the hypothesis of abiogenesis, to cry down every attempt made looking toward the artificial production of life. At various times Spencer, Huxley, Darwin, and Pasteur were firmly convinced that they had found the secret of life, but repeated experiments wherein antecedent life was more rigorously excluded than before proved their efforts futile.

Evidently error of a similar nature has crept into the tests of Dr. Littlefield, and this is not said without due consideration, for the present writer has performed the experiment as above written, not one but many times, and in every instance the result was not successful beyond the mere crystallization of the chlorides.

It is true that more recent reports state that the development took place under sealed glasses thoroughly sterilized before beginning and sealed from the air when placed on the shelf, but it is obvious that there was every chance for pre-existing life to slip in, and so what would otherwise have been regarded as a wonderful achievement in science has not been taken very seriously by men skilled in either chemistry or biology.



Microphotograph of Supposed Flora. The Original Lifeless Material. Fern-like Forms.



SOME OF DR. LITTLEFIELD'S SUPPOSED CREATIONS OF ARTIFICIAL LIFE.

Beznau Hydraulic Station.

The hydraulic plant of Beznau, on the Aar River, situated about five miles above the point where that stream flows into the Rhine, is employed to distribute current throughout a very extensive region. It has three main transmission lines which run in different directions through the region. Lines at 25,000 volts run by various localities to Rheinfelden at a distance of 28 miles, to Entfelden (20 miles) and to Seebach (21 miles) and thence to Zurich, while near the station there are shorter lines which work at 8,000 volts. When fully completed the central plant of Beznau will be provided with eleven alternating-current dynamos, mounted on the vertical turbine shafts. Each of these machines delivers 1,000 to 1,200 horse-power, and runs at 67 revolutions per minute. They produce a tension of 8,000 volts. Six of these dynamos are now in the station and three others are building. Current for the field coil is furnished by small 400-horse-power dynamos which give a tension of 200 volts. The machines thus deliver 8,000 volts to the lines directly and 25,000 volts to the other circuit by means of a set of transformers which raise the tension. Power is used throughout a very extensive region, for electric motors in factories, for lighting and tramways. The electric part of the Beznau plant has been installed by the Brown-Boveri firm, while the vertical-shaft turbines are built by Theodore Bell & Co. at the Lucerne works. At Rheinfelden there is a 3,000-horse-power sub-station which receives the high-tension current and lowers it to the voltage needed for use in the town, and helps out the hydraulic plant on the Rhine at that point.

Pistols for cavalry, first manufactured at Pistoja in Italy, were made in England, 1544; fire ships, 1585-8; balloons (by Mendoza) 1620; air-guns, 1646; bayonets at Bayonne, 1670; and throughout the period great improvements were effected in cannons and small arms, among others, the breech-loading gun and revolving pistol, specimens of which, made and used in the sixteenth century, can still be seen in the national museums of Europe.—Del Mar's "History of Monetary Systems."

A NEW METHOD OF IDENTIFYING CRIMINALS.

BY L. RAMAKERS.

In our issue of December 17, 1904, we gave a description of Dr. Bertillon's system of identification. But it is desirable not only to be able to identify an habitual criminal after he has fallen into the hands of justice, but also to be able to recognize him in a crowded street at sight, instinctively and without stopping to measure him. Such recognition is a very important and a very difficult matter, which often leads to error.

In order to avoid, as far as possible, mistakes of this sort, which are always greatly to be regretted and often entail serious consequences, all the inspectors of the Paris prefecture of police now take a course of instruction in descriptive identification, or the method of the "verbal portrait," as it is also called. At the end of the course, which comprises twenty lessons of one hour's duration, the pupils receive diplomas certifying that they are qualified to receive and utilize such descriptions.

This course was instituted as a result of the following observation, which had been made repeatedly:

An inspector of police and, in general, every person unfamiliar with the application of the "verbal portrait," though possessing the photograph of an individual, will pass by that individual without recognition, if the photograph is a few years old or if the general appearance has been altered by a gain or loss of flesh, or by a change in the beard, or the hair, or even the clothes. On the other hand, descriptive identification, which means an accurate description of the immovable parts of the face (forehead, nose, ears, etc.), enables those who are sufficiently familiar with the method to identify a person with certainty, not only with the aid of a photograph, but also simply by means of a printed description of those characteristics of the person in question which are out of the ordinary.

Another school of descriptive identification has been in existence for a short time in Bucharest. The experiment described below was made very recently by the director of that school, M. Minovia.

At the moment of starting of a crowded passenger train, the description of one of the passengers was given to two police pupils, who were then at the front and rear ends of the train. Before the next station was reached the person described had been recognized and identified, although he was disguised as completely as possible. The method of descriptive identification is based upon the following principle:

Suppose, for example, that we wish to describe the shape of the nose of every person that we are called upon to meet. The customary terms "straight," "aquiline," "flat," "pug," etc., enable us in some cases to give an approximate idea of the organ in question, but in most cases no known appellation will suggest itself as appropriate.

It is necessary, then, to analyze, to separate the characteristics until we arrive at categories which we can distinguish by common words, such as "small," "medium," "large," etc., or other analogous series.

Thus, for the purpose of studying the form of the nose, the profile of the organ is divided into two perfectly distinct parts; the front, extending from the root to the tip, and the base, extending from the tip to the junction of the nostril with the cheek. The

Two Finger Prints.

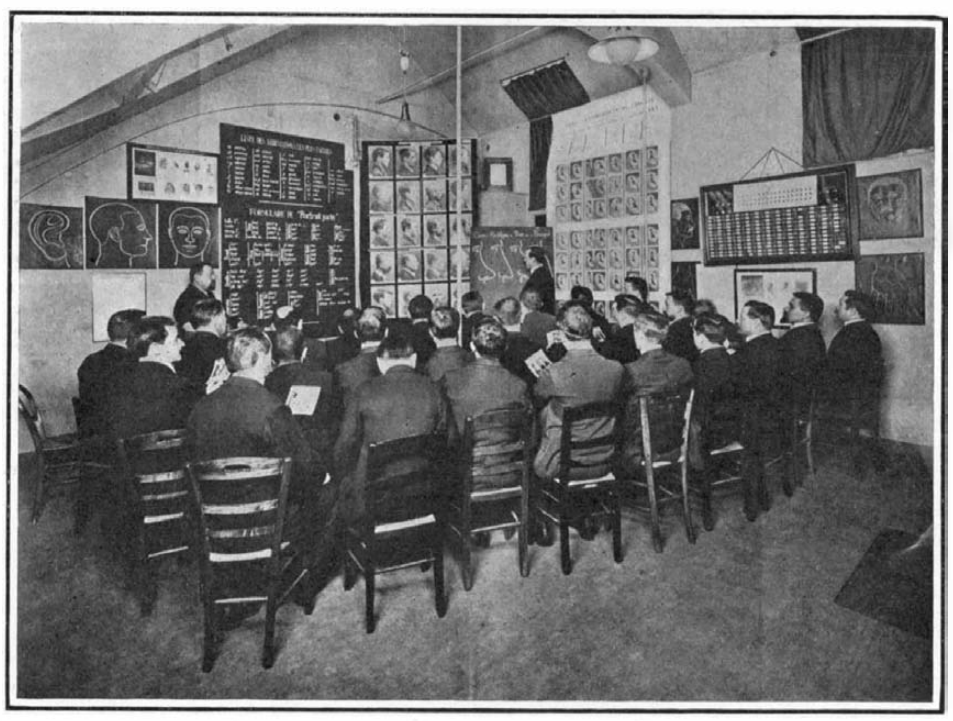
different forms of the front of the nose, "hollow," "straight," and "convex," may then be combined with the inclinations of the base, "upward," "horizontal," and "downward." Besides, for every form of the nose, its three dimensions vary independently of each other, and are indicated by a series of terms, ranging from "very small" to "very large."

This method of instantaneous analysis, which allows the form and dimensions of the nose to be identified with precision, has been applied to other parts, especially to the ear, which suffices in itself for the establishment of identity, in many cases.

The general contour of the head, seen from in front, also presents various abnormal forms, and thus gives valuable assistance in the reconstruction of the "verbal portrait." We distinguish round, square, oblong, pyramidal, top-shaped, diamond-shaped faces, etc.

In regard to the system of identification in general, and the tracking of criminals, we may add a few words concerning finger prints, the lines of which exhibit details which are absolutely personal.

Very often, on the scene of a crime, finger marks are found on glossy surfaces (bottles, glasses, window panes, door plates, painted and varnished walls, etc.). By a comparison of such impressions, photographed by a special process, it is easy either to discover the maker of the finger marks observed at the scene of the crime, or to establish the innocence of a suspected person whose digital impressions have nothing in common with those marks.

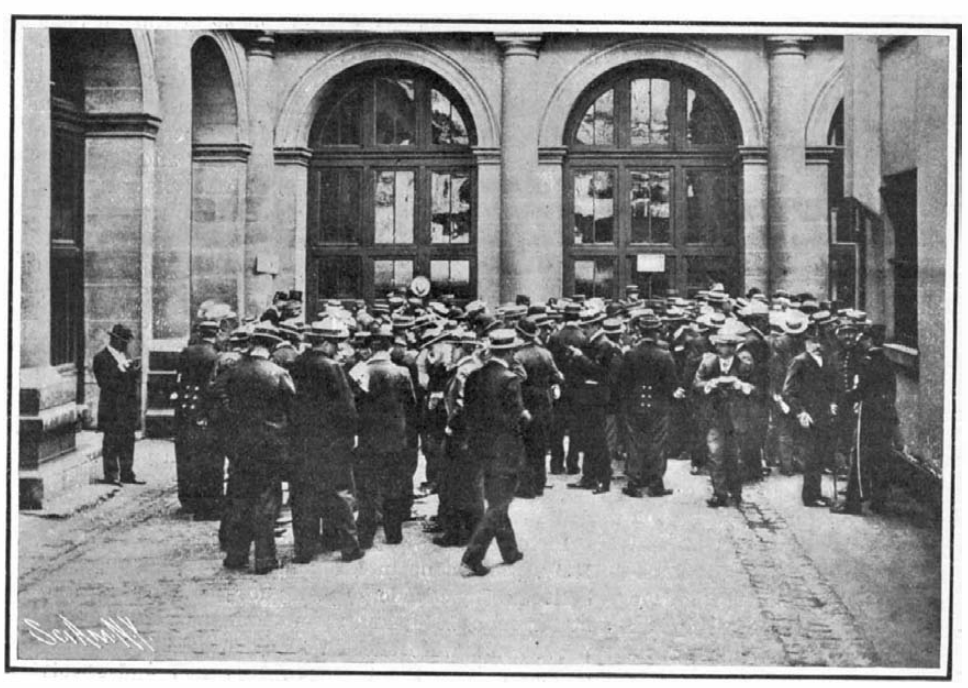


A Lecture on the Theory of Descriptive Identification at the Paris Prefecture of Police.

Automobiles in Army Maneuvers.

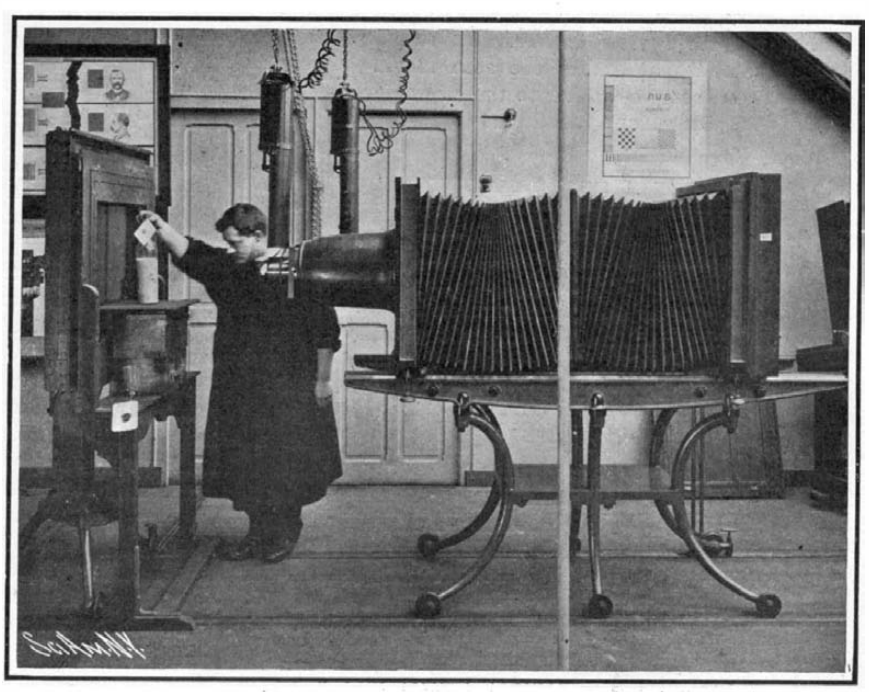
Automobiles are to figure to a considerable extent in the autumn military maneuvers which will occupy the months of September and October, especially in France, Germany, and Italy. As regards France, it is stated that the forty-five chauffeurs who form part of the reserve of the active army and are to put their cars at the disposal of the officers during the grand maneuvers of the North and East, were passed in review at the headquarters at Vincennes, near Paris, early in September. Capt. Genty, who is well known as the chief of the automobile service, has the matter in charge. He is piloted by De la Touloubse, who has figured in different racing events with the Darracq cars. During the maneuvers of the West, three tractors will assure an active service of supplies. The tractors will be in charge of the military chauffeurs of Capt. Genty's corps. As Caillois, one of the winners in the Gordon Bennett cup race, is not to enter the Vanderbilt cup, Gen. Desirier, the military governor of Paris, who is familiar with his remarkable skill, asked him to be his pilot during this year's maneuvers. Caillois will, therefore, figure in a prominent place during these events. As regards the use of automobiles in the Italian army, the volunteer chauffeurs of the Milan Automobile Club, who are to take part in the maneuvers in the Abruzzi region, have been placed under the direct command of an officer of the Etat Major attached to the direction of the maneuvers. The chauffeurs are to be divided into three groups. One of these will assure the service of the general command of the maneuvers and the other two are attached to the two armies of the North and South respectively. To each of these groups will be attached the officers and men who are charged with organizing the movable garages and the repair shops for the cars. In Germany considerable prominence is to be given to automobiles, as heretofore. The Etat Major has been greatly pleased with the volunteer automobile corps which took part in the exploration maneuvers between Posen and Grandez. The corps showed a great efficiency on this occasion. It has been decided that during the grand maneuvers thirty-six volunteer chauffeurs will take part in the exercises with their cars.

The population of Japan proper is estimated at 47,812,702 for the present year.



Practical Exercises in Identification.

Each pupil, having received the description of some one of the persons present, endeavors to identify and "arrest" him. Experience shows that the method, properly applied, cannot lead to the slightest confusion of identity.



A Camera Specially Designed for Photographing Finger Marks on Glossy Surfaces.

A NEW METHOD OF IDENTIFYING CRIMINALS.

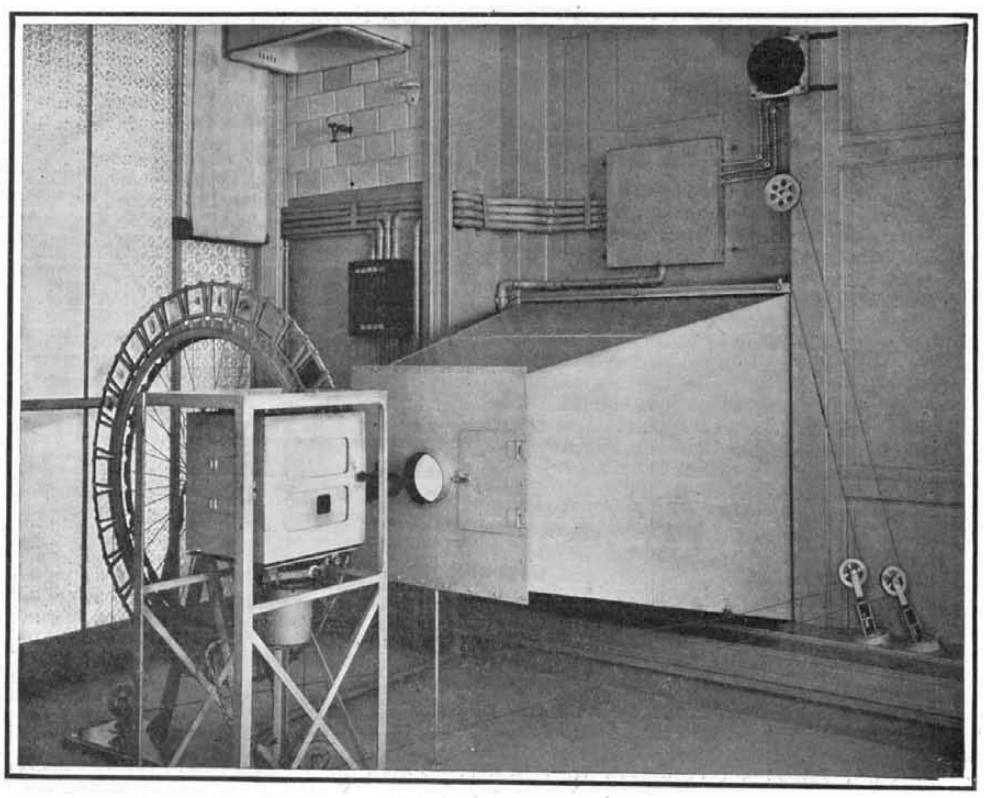
A NEW PROJECTION SYSTEM FOR LECTURES.

BY DR. ALFRED GRADENWITZ.

The usefulness of lantern slides for purposes of illustration in connection with lectures is generally appreciated. An improved projection system, illustrated herewith, has been designed by Prof. Eric Gérard, of Ghent, Belgium. The necessity for darkening the auditorium and employing an assistant who is liable to give rise to trouble by confusing the pictures has often been found to be a serious drawback. The Gérard system permits the projection of diapositives in full light and without the aid of an assistant.

The projection screen is a sheet of plate glass, nearly 4 feet square, ground by means of a sandblast to provide a rougher surface than glass ground in the usual manner with acids. To avoid the necessity of darkening the room, a sheet-iron casing is provided which connects the screen with the projection lantern, thus inclosing the light beams and cutting off any side light. The projection lantern contains a continuous-current arc lamp with a regulator, adjusted for 15 amperes and located at a distance of about 7 feet from the screen. The beam of light obtained under these conditions is sufficiently strong to allow the projected image to be seen transparently through the ground glass throughout an auditorium containing 300 seats, while the room remains lighted up.

In order to dispense with the services of an assistant in bringing the slides successively before the lantern, all the slides to be used in a lecture are arranged beforehand at the periphery of a wheel resembling a bicycle wheel. By means of a special gearing the wheel is set rotating with a crank situated below the screen, so as to cause the slides successively to pass through the lantern. The wheel can be turned backward and forward at will, so that any given picture can be reproduced over again. A switch placed beside the controlling crank serves to light the projection lamp.



A NEW PROJECTION SYSTEM FOR LECTURES.

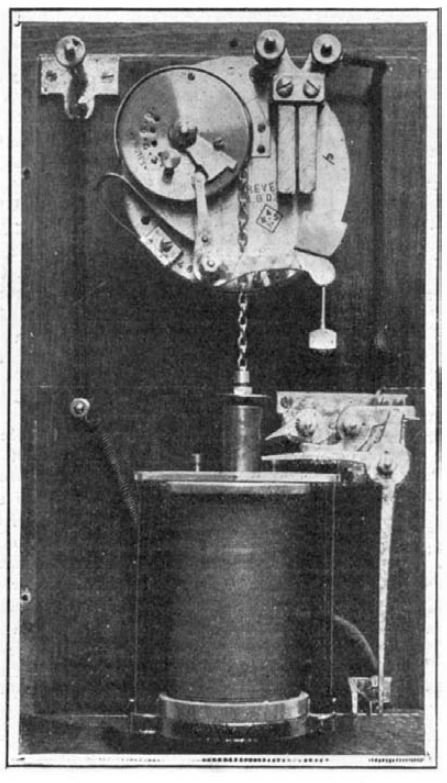
A NEW APPARATUS FOR AUTOMATICALLY MAKING AND BREAKING AN ELECTRIC CIRCUIT.

BY EMILE GUARINI.

The circuit maker and breaker recently invented by M. E. Salomon, of Vincennes (France) has the three following important characteristics: It is automatic, the duration of its operation may be regulated at will, and it is provided with a suitable switch. The main part of the apparatus is a solenoid which attracts a core connected by a chain with a grooved pulley mounted upon the axis of a barrel that forms part of a clockwork movement. The pulley is provided with a stop and with holes into which a setscrew can be inserted and which are numbered with figures that designate the number of minutes that the apparatus is to operate. Upon the axis of the pulley is mounted a cam, while a right-angled lever having the horizontal arm insulated, carries on the end of the latter a knife blade that engages two spring contact members below in order to close the circuit of the lights or other apparatus to be set in operation. When the switch thus formed is closed, a pin that holds the balance wheel of a clockwork movement is withdrawn, and the movement operates and turns the pulley. In order to actuate the apparatus it suffices to send a current through the solenoid from any point whatever, when the core will be attracted and will close the switch, thus releasing the pulley, as above described. As the pulley turns, the cam will move to the left of the vertical arm of the right-angled lever, while the knife blade on the other arm will engage with the two contact members and close the circuit. At the same time the clockwork will be set in motion. The clockwork rotates the pulley in the opposite direction until the pin set in one of the five holes strikes the notched cam, causing it to release the right-angled lever, which is returned to the position shown, by the flat U-shaped spring at its left. The lighting circuit is opened. A pin stops the balance wheel of the movement.

The current reaches the solenoid through one binding post and makes its exit through a second. In the operative state, the disk of the core is placed above the nose of a cam. When the core is attracted, the disk bears against the horizontal arm of a rectangular lever, causing the vertical arm to leave a contact and break the circuit of the solenoid. The lever is held by a pin fixed to the extremity of a detent. When the pulley turns, the core rises, the disk lifts the nose of the cam, the pin is disengaged, and the current is again set up. The interval of time between the releasing of the main lever (which opens the knife switch) and the releasing of the other lever (which again makes the circuit of the solenoid) is equal to the interval between the closing of the main switch and the opening of same; so that the electrical circuit controlling the lights or any other apparatus is made for a certain number of minutes and then broken again for the same number.

It is possible to cause the apparatus to operate automatically by utilizing the clockwork movement, or instantaneously by moving the switch by hand. A small handle is attached to the arm carrying the knife blade for this purpose.

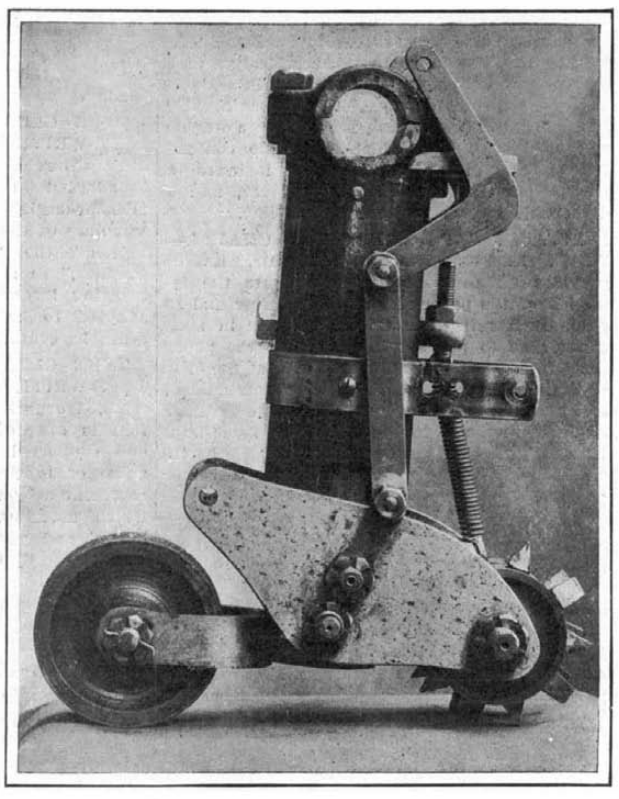


AUTOMATIC LIGHTER AND EXTINGUISHER.

A NOVEL DEVICE FOR PREVENTING AUTOMOBILES FROM SKIDDING.

Every automobilist is only too painfully aware of the ever-present liability of his vehicle to sideslip with its attendant dangers, especially when traveling over wet and greasy surfaces. An interesting device for the purpose of preventing such skidding has been invented by Messrs. Revill and Price, of London. As will be seen from the accompanying illustration, the contrivance is of simple construction. It is attached to the rear axle of the vehicle. There is a small trailing wheel carried at the lower extremity of the main vertical member attached to the axle. This wheel can be brought to bear upon the surface of the road and so maintained in contact therewith for as long as may be desired by the driver; and it is applied or released by the operation of a handle, pedal, or other suitable device operated from the driver's seat. As long as the trailing wheel is in contact with the ground, being supported as it is upon a vertical pivot, it is capable of rocking this pivot whenever the car commences to slide sideways, with the result that this movement of the pivot applies to the ground a second toothed gripping wheel, or a set of toothed wheels, these being held to the ground as long as any sidewise impulse is received by the trailing wheel above mentioned. Immediately the trailing wheel assumes its usually direct line, that is, as soon as the pivoted arm carrying the trailing wheel again becomes parallel to the direction of motion of the car, the gripping wheels automatically rise from contact with the ground, as their work is completed. Directly another tendency to sideslip in either direction arises, the trailing wheel is again deflected, and again brings the gripping wheels into contact with the ground and so prevents any further skidding.

The device is thus entirely automatic in its action as long as the trailing wheel is in contact with the ground; and it provides a simple, strong, and efficient device, by which the dangers of side-slip may be entirely eliminated. The appliance shown in the accompanying illustration is designed for a 30-horse-power car. Its weight is 30 pounds. It can be easily and quickly connected to the axle, the connecting bearing being divided for this purpose and locked in position by two nuts and bolts.



A DEVICE FOR PREVENTING THE SKIDDING OF AUTOMOBILE TIRES.

A Robert Fulton Centennial.

An excellent plan has been started for celebrating the centennial of steam navigation. The idea comes from the Fulton Centennial Commission.

Gustav H. Schwab was in favor of a permanent memorial. His idea of such a memorial is a "magnificent water gate, the whole surmounted by an arch, with steps spreading down to the water at the Battery."

Mr. Louis T. Romaine indorsed Mr. Schwab's suggestion of a monumental arch and water gate, as did also Rear Admiral Melville.

Owing to the great success that has attended the Japanese naval department in regard to the use of large and formidable battleships, this unit is to be considerably developed. Contracts have been placed in England for two vessels, each displacing about 19,000 tons. One is already in hand at the dockyard of Messrs. Vickers, Sons & Maxim, while the second vessel will probably be constructed at the Elswick shipyard. These vessels are the largest that have yet been laid down by any navy, and exceed the "Connecticut" by 3,000 tons, and the latest battleship development of the British navy—the "Lord Nelson" class—by 2,500 tons. At the present time there are in course of building for the Japanese navy five battleships aggregating 88,350 tons, and two armored cruisers each of 13,500 tons, representing a total of 101,850 tons irrespective of the small type of war craft.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

TELEGRAPH-TRANSMITTER. — W. H. LEONARD, Mount Vernon, N. Y., and J. H. LEWIS, New York, N. Y. Devices which have been constructed for the purpose where the striking of a key will automatically transmit a character of the Morse alphabet upon a telegraph-line are open to many objections. They have to be wound up before they will operate; if the finger is kept too long upon a key it will transmit the same character repeatedly, and they are expensive in construction, therefore their use in practice is limited. The present device eliminates these disadvantages.

TROLLEY.—W. S. TICHENOR, Owensville, Ind. In Mr. Tichenor's patent, the invention has reference to improvements in trolleys for overhead electric-railway systems, the object being the provision of a trolley of simple and inexpensive construction and having shaft-bearings that are practically dirt and dust proof.

MAGNETO-ELECTRIC GENERATOR. — R. C. CROUCH and J. A. TITZEL, SR., Newcastle, Pa. The invention relates to magneto-electric generators, the more particular object being to produce a type of generator suitable for the production of comparatively weak currents when subjected to movements—as, for instance, the movements of a person when the apparatus is carried in the pocket.

Of Interest to Farmers.

PLOW.—J. B. HUNTER, Woodlawn, Ill. One purpose in this invention is to provide a means for securing the share of a plow to the moldboard and the landside to the beam in a removable manner and without the use of bolts and nuts, and, further, to provide means for making the connection with rapidity and least possible trouble. Another purpose is to provide an attachment which while particularly adapted for turning plows of all kinds is equally well adapted to one-horse or two-horse plows, gang and sulky plows.

Of General Interest.

SMELTING-FURNACE.—H. L. WRINKLE and N. WRINKLE, Keeler, Cal. The invention is especially intended for use in connection with fluid or pulverized fuel, the arrangement being such that the material charged into the furnace lies in conical position in the crucible, the fuel gases being circulated around the sides of the conical mass of material. The furnace also involves a peculiar roof structure which not only strengthens the furnace but provides chambers facilitating heating the air blast.

ORE-CONCENTRATOR.—W. O. JOURNEAY, San Antonio, Texas. This patentee's invention is designed to improve the construction of ore-concentrators whereby to better control the supply of the pulp and the water supplied thereto and to better regulate the discharge of the concentrates and tailings; the object being to give an increased capacity to the machine which is designed to operate continuously.

DEODORIZING APPARATUS.—J. B. SUTHERLAND, Seattle, Wash. One purpose of the inventor is to provide an apparatus for preventing the escape of objectionable odors or gases from cooking-tanks, rendering-tanks, or the buildings which contain said tanks, said vessels being of that character used in packing-houses, slaughter-houses, or fertilizer-works; and a further purpose to provide a readily applied means whereby the causes of the odors are trapped in their passage from the rendering-tank to the catch-basin or sewer.

OVERHEAD-CONVEYER SYSTEM.—J. F. MCKAY and D. J. MCKAY, Bowie, La. This invention refers to cableways, especially those for "skidding" logs. Difficulty has been met drawing out the skidding-line and the present improvements provide means for paying out the skidding-line after the outward movement of the carriage and preparatory to loading or reloading it. The invention also contemplates a loading-carriage which is employed in connection with one of the guides for the main cable and which permits loading the logs on a wagon, railway-car, or like vehicle. It also contemplates other improvements; for instance—a tension-block, a double-block structure, and a detachable section for the skidding-line.

ATTACHMENT FOR BARBERS' CHAIRS.—A. D. KANDLE, Pencoyd, Pa. Mr. Kandle provides means whereby to facilitate the insertion of the paper-roll in the cylinder and to guide such roll when in the cylinder in such manner as to prevent the edges of the paper sheet from tearing against the metal at the ends of the slot through which each sheet is guided, and also to brace the open end of the cylinder adjacent to the slotted way for the paper both internally and externally in the use of the invention. It is an improvement over a former patent granted to this inventor.

DISPENSING-BOTTLE.—C. B. FORSYTH, Alexandria Bay, N. Y. In the operation of the bottle the person wishing to use a portion of its contents will touch a stem, so as to unseat a plug in an upward direction. A quantity of the fluid will then flow down to a perforation and through a conical bore, as desired. As soon as released a spring will operate the plug once more and close the outlet from the bottle. The receptacle is for the use of antiseptic liquids, liquid soap, etc.

FLY AND MOSQUITO GUN.—R. PETERSEN, Asbury Park, N. J. This invention refers to improvements of guns by means of which any person can catch and destroy flies and other insects. When operated, a person takes hold on a handle with one hand and the rear end of shooting-rod with the other and pulls his hands apart and then relieves the rod and it will shoot out quickly. If aimed at a fly on the wall, the fly will attempt to escape, then the catchers slam together and kill it.

SOUND-AMPLIFIER PHONOGRAPH. — R. B. SMITH, 153 Third Avenue, New York city, N. Y., and C. MCCARTHY, 2380 Broadway, New York. This invention relates to improvements in devices for amplifying sounds from phonographs or like machines, an object being to provide a reproducer comprising a plurality of diaphragms so arranged as to be acted upon synchronously, whereby the sounds from the several diaphragms will be so blended as to be emitted from the sound horn as a single sound, and much more distinct than is possible with the ordinary reproducer.

ILLUSION APPARATUS.—R. B. SMITH, 153 Third Avenue, New York, N. Y., and C. MCCARTHY, 2380 Broadway, New York, N. Y. Provision is made in this invention for effective and readily-operated means for securing a delusion effect, and the improvement is particularly adapted for the stage. The vehicle is capable of four distinct primary movements that may be applied singly or two or more impressed simultaneously upon the automobile floating in the air, so that it may be caused to describe complex curved paths, during which it turns to proceed in opposite directions. Any or all motions may be stopped at will. While the apparatus is upon the stage all elements except vehicle and occupants are concealed. Thus the car appears guided through air across the stage space, turns around and returns, then ascends until upside down and returns to the stage again, without support. Simple mechanism operates it from behind the scenes, a special system lights the stage, and motion to the wheels is given by silent electric means.

Household Utilities.

SCREEN.—J. STORK, San Diego, Cal. The invention relates more particularly to those window-screens which roll in the manner of a curtain and which are especially adapted to cooperate with the upper window-sash. Its principal objects are to provide an efficient arrangement in which positive movement in operation is imparted to both the screen and its support. It is sightly, durable, keeps tight, and kinking upon the roll is impossible, while the movement of the sash is utilized to secure these results without complication.

BABY-CABINET.—MARY A. KUYKENDALL, Portland, Ore. One intention in this case is to provide a cabinet of convenient size, adapted for movement in any direction over the floor, comfortably padded, and having an open top, thus affording a box-like receptacle wherein an infant may be placed on a bed, and kept out of danger. Another is to provide inner handholds, which enable a baby to get upon its feet and learn to walk around the walls of the structure without being bruised in case of falling, and a further intention, to provide a holder to place playthings.

WINDOW.—C. CHABAU, New York, N. Y. This window belongs to the class designed to be swung into a room for the purpose of conveniently cleaning the outer side of the glass, the object being to provide a supplemental swinging casing in which the upper and lower sash are arranged to slide and whereby both sashes may be moved together in the inner side of a room.

Machines and Mechanical Devices.

LOADING AND UNLOADING MACHINE.—S. MUNSON, Fowler, Col. Mr. Munson's invention refers to a machine for loading and unloading which is capable of many uses, but is especially adapted for the transportation of rails. The objects are to provide convenient, efficient, and inexpensive means which can be mounted upon an ordinary flat or coal car for unloading rails therefrom or transferring them thereto.

TYPE-CLEANING ATTACHMENT FOR TYPE-WRITING MACHINES.—J. H. LADD, Falls Church, Va. This type-cleaning device is adapted to be detachably secured to the ribbon-carrying bar or plate of type-writing machines of the class represented by the "Remington," the "Densmore," and the "Smith Premier," in all of which machines the type-carrying levers are arranged in a circle and adapted to be thrown upward to bring the types in contact with the ribbon.

TYPE-CLEANING ATTACHMENT FOR TYPE-WRITING MACHINES.—R. C. HAMMILL, Woodbridge, Va. Mr. Hammill's invention is adapted to be detachably secured to and supported by the ribbon-carrying bar or guide of type-writing machines of that class represented by the well-known "Remington," in which machines the type-carrying levers are hinged and pendent in a circle traversed diametrically by the ribbon-guide. It is small in size, may be quickly applied to and removed from the ribbon-guide, and is self-fastening and self-supporting in the guide.

Railways and Their Accessories.

COLLAPSIBLE BLIND OR SHUTTER.—G. MCMULLEN, Perth, Western Australia, Australia. This improvement has reference to lath blinds and shutters, and more particularly to that kind of blind usually fitted in tram and railway cars and such like vehicles for intercepting the rays of the sun and also allowing the air to pass freely through the car, such blinds acting as auxiliaries for the ordinary glass windows.

EXTENSION CAR-STEP.—G. G. COMER, Kalama, Wash. In this patent the invention pertains to improvements in extension-steps for passenger cars or coaches, the object being to provide steps that may be readily attached to the ordinary fixed steps and so arranged as to be easily moved to and held in its lowered position and moved automatically to its upper position when not required for use.

Designs.

DESIGN FOR A POCKET SAFETY-CLIP FOR FOUNTAIN-PENS AND PENCILS.—M. H. DURYEA, Hackensack, N. J. Mr. Duryea has invented a new, original, and ornamental design for a pocket safety-clip for fountain-pens and pencils, comprising a human hand firmly gripping the ring portion of the clip.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7290.—For manufacturers of moving and gypsy wagons.

Have you much figuring to do, chiefly *multiplication* and *division*? The "*Brunsviga*" will save you 90 per cent of time and all mental effort. 18 and 13 figures products. Automatic devices make error impossible. Simple. Lasts lifetime. Sent on trial. FELIX HAMBURGER, 90 William Street, New York.

Inquiry No. 7291.—Wanted, manufacturers of collapsible lead tubes, for pastes, also for makers of small pasteboard boxes for tablets.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7292.—For makers of tin mucilage brushes and caps.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7293.—Wanted, machinery for manufacturing or converting sisal or hemp from the plant.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7294.—For parties to make small stamped steel novelty work, also makers of machinery and outfits for such work.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7295.—For makers of engine gang plows for use behind traction engines.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 7296.—For makers of hand swinging acetylene lamps.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7297.—For a machine for cutting "scrub," i. e., small trees of hardwood varying from the diameter of a straw to two inches.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7298.—Wanted, catalogues and prices of soap manufacturing machinery, and estimate on complete outfit for making 1,000 to 5,000 pounds of soap per 10 hours.

WANTED.—Patented specialties of merit, to manufacture and market. Power Specialty Co., Detroit, Mich.

Inquiry No. 7299.—For manufacturers of aluminum paper.

Wanted to manufacture some light, quick-selling article. Fully equipped plant.
F. G. Waterhouse, Flatiron Bldg., N. Y.

Inquiry No. 7300.—Wanted, drawing and patterns for making small rowboats.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7301.—For makers of tinfoil.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7302.—For makers of metal horns such as used on talking machines.

Mechanical devices of brass, aluminum, and kindred metals manufactured for inventors and patentees, and marketed on royalty, when desired. Imperial Brass Mfg. Co., 241 So. Jefferson St., Chicago, Ill.

Inquiry No. 7303.—Wanted, right to build a good make of gasoline engine in Canada.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 7304.—Wanted, a machine for filing small saws.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7305.—For the manufacturers of the Buffalo Hot Air Engine, also of the "Essex," or for a small hot air engine, 1-40 to 1-8 h. p.

WANTED.—The patents or sole agency for Britain and France, of new machines and articles used in the Brewing and Allied Trades. Highest references given and required. State best terms with full particulars to "Wideawake," care of Street's Agency, 30 Cornhill, London, England.

Inquiry No. 7306.—Wanted, hand-braided cotton line ⅛ inch diameter, in loops of about 20 inches; endless, braided at ends.

Inquiry No. 7307.—Wanted, a first-class pattern maker, to do accurate work from blue prints.

Inquiry No. 7308.—Wanted, address of manufacturers of metal diaphragms, such as are used in telephone transmitters and receivers.

Inquiry No. 7309.—For makers of evaporators for evaporating apples.

Inquiry No. 7310.—Wanted, catalogues of machines for cleaning fiber sisal.

Inquiry No. 7311.—Wanted, catalogues of running gears, equipped with wheels and differential gear, to be bevel-driven, not chain; also for catalogues of magnetos for jump spark ignition, with or without coil, also of clutches.

HINTS TO CORRESPONDENTS.

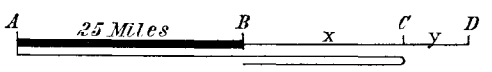
Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9784) J. A. H. asks: Will you kindly explain in your Notes and Queries column a fact that has puzzled me a good deal? Why is it that lightning should splinter a tree up as it does? Now, lightning being electricity, has no shape or weight, and consequently can have no momentum or purely mechanical energy which it would impart to the tree in tearing it to pieces. Will you kindly try to clear up this question? A. Although electricity is not supposed to have ordinary mechanical properties such as momentum, weight, etc., it yet has the ability to produce these effects in other bodies. A shock of a small coil will give a very savage jerk to an arm or a leg, and the blow or kick given is a striking mechanical effect. The shattering of trees and structures by lightning may be in part accounted for by the sudden evolution of heat, vaporizing the water in the tree, expanding the gases, and producing all the effects of an explosion.

(9785) F. G. S. asks: Is there any simple formula for calculating the power of a magnet when the size of wire, number of turns, and E. M. F. of battery are known? Will this formula apply in the case of a solenoid? A. The tractive power of a magnet is found by the formula Pounds $= \frac{T C M \sqrt{A}}{2661\, L}$ in which T is the number of turns of wire, C the current in amperes, M the permeability of the iron of the core, A the area of pole pieces, and L the mean length of the magnetic circuit. For a solenoid without iron the permeability is 1, since the permeability of the air is the standard of comparison, and hence is unity. For a straight coil the result will be of little value because of the great leakage of lines of force, and the great length of the circuit of the lines in the air.

(9786) E. C. S. writes us: Solution of problem of soldiers and couriers, SCIENTIFIC AMERICAN September 2, 1905, page 186, No. 9750.

Let $A\,B$ represent the column at the time of commencing its march, the courier being at A. While the column moves a distance equal to $B\,C$, the courier moves from A to C; and while



the column moves a distance equal to $C\,D$, the courier moves from C to B.

Let x represent $B\,C$, and y represent $C\,D$.

Then $x + y = 25$ (1)

$x + y - 25 = 0$ (2)

Now, as the column moves at a *uniform rate of speed throughout*, and that of the courier is also *constant*:

$(x + 25) : x :: x : y$ (3)

$xy + 25y = x^2$ (4)

$xy + 25y - x^2 = 0$ (5)

Multiplying (2) by x, $x^2 + xy - 25x = 0$ (6)

Subtracting (5) $\quad -x^2 + xy + 25y = 0$ (7)

$2x^2 - 25x - 25y = 0$

Multiplying (1) by 25, $25x + 25y = 625$ (8)

Then by addition: $2x^2 = 625$ (9)

$x^2 = 312.5$

$x = \sqrt{312.5} = 17.6776+$

Therefore the distance the courier traveled was equal to 25 miles plus $2x$ = Ans. 60.3553+ miles. I do not think the *rate per hour* necessarily enters into a consideration of this problem, as it could quite as well be a rate *per minute* or *per year*, or even that of Mark Twain's famous glacier.

(9787) J. A. T. writes: Yesterday about four o'clock in the afternoon, while looking toward the east, I saw what looked to be a meteor in the heavens traveling toward the east—quite a ball of fire, about the size of a child's head, with a long tail. Now, this looked to be very near, so much so that one would believe it fell as near as three miles from where I was standing. Now, do you think this possible, or is it very deceiving to the sight, and could it have been in some other atmosphere? I think I have read of where they have fallen on the earth, and it would interest me very much to have this reported. A. The observation of a meteor in the air by daylight is interesting. It is not likely that it was as near as three miles, however. Had it been no farther away, it

would have seemed just at hand. Many of these bodies have fallen to the earth, and may be seen in our museums.

(9788) L. E. S. asks: 1. Increase in distance requires *finer* wire, or a greater number of ohms resistance, in the telegraphic relay. Why is this? A. A greater distance requires a finer wire on a telegraphic relay in order to secure a greater number of turns of wire in the same space, so that the magnetizing power of the current may be as great as possible. The increase in the number of turns of wire is more important than the increase of resistance due to the finer wire. 2. Why is the glass front in the search light divided into *vertical strips of glass?* A. The glass in the front of a search light is divided into strips to reduce the loss if a crack is made by the heat. These need not be vertical. 3. A telegraphic cable crossing the ocean is broken. The broken place is some distance from shore. How can the distance from shore to the end of the broken cable be ascertained? What instrument is used? A. The distance to a break in a cable is determined by measuring the resistance of the cable to the break, at which point the wires are grounded, and hence have no resistance. Since the resistance per mile is already known, it is easy to calculate the distance to the break by dividing the measured resistance to the break by the resistance per mile. 4. What is the greatest number of volts that have been passed through the human body without harm? A. Volts are not passed anywhere in an electric circuit. Volts are the pressure which makes the amperes flow, and amperes do the harm to the person who receives the current. If the current has a high voltage, the shock is more severe. Men have received shocks from circuits with 2,500 volts on them without special harm, and again men have been killed when the voltage is only 500. The effect depends upon something more important than volts; that is, upon the resistance of the man who receives the shock. This is affected by the moisture or dryness of his skin and clothing, and to an extent perhaps upon his nervous condition. It depends also upon the time which the current acts upon the man. This answer relates to commercial circuits and heavy currents. When the current is that of an induction coil or high-tension transformer, such as Mr. Tesla used in his famous experiments, a million or more volts seem to be without any perceptible effect. A man may hold an incandescent lamp bulb in his hand, and the sparks fly for a long distance through the air to the lamp and light it to full candle power, while he feels nothing of the current which is passing through him. Your question then does not admit of a categorical answer.

(9789) C. P. P. asks: Will you kindly answer the following question through the column of notes and queries in your valuable paper: Which succeeds the other, day or night? A. In our calendar the day begins at midnight and the morning precedes the afternoon. The answer to your question, however, is, day succeeds night and night succeeds day in ceaseless round.

(9790) H. M. asks: 1. Could not the core of an induction coil be made longer and the secondary coil be placed beside the primary coil and not over it, and thus save considerable length of wire, and also number of turns of wire in secondary? A. Induction coils have been made with almost every possible relation of the various parts, with the result that it is a general agreement of experimenters that the usual mode of arranging is the best. The secondary coil is sometimes placed by the side of the primary in the transforming of alternating currents for lighting, but then the core is especially designed to save the lines of force. In coils for giving sparks the core should not be unnecessarily long, since the object is to secure as sudden a demagnetization of the core as possible. You would better conform to the proportions of coils as given in the best books. Take Norrie's "Induction Coils," for a guide. We can furnish it for $1. 2. Do the outer coils of the secondary add as much strength to the coil as do the turns of wire wound nearest the core? A. The outer turns of secondary wire have not the same value in producing current as do the turns near the primary. The mode of securing a small-sized secondary is to use the finest possible wire. No. 36 to 40 is employed. 3. How is the magnetic resistance of a piece of iron calculated? If I know the ampere turns how may I know the strength of the magnet? A. The magnetic resistance, or reluctance, as it is called, is equal to the length of the circuit divided by the product of the permeability by the area of cross section of the iron. The tractive power of a magnet in pounds is found by the formula,

$$\text{Pounds} = \frac{TC \cdot M \cdot \sqrt{A}}{2661\,L}$$

in which TC is the ampere turns, M is the permeability, A is the area of cross section of poles, and L is the mean length of magnetic circuit. 4. What voltage will a five-bar telephone generator furnish? A. The ordinary telephone generator will give from 65 to 75 volts. What a five-bar generator gives we are not able to say. 5. Why is it that a generator requires more power to turn its armature when delivering heavy current than when on open circuit? A. The generator requires more power to drive its armature when it is delivering current because it is then doing work. An engine running free does not require much power, but when heavy machinery is connected to it, it requires much steam to drive it. 6. Can you give me the formula for constructing a tangent galvanometer so that certain degrees deflection will equal certain value of current? A. A deflection of a certain number of degrees always represents the same current in a given tangent galvanometer. You do not require any special formula to determine the current for any deflection. Use the ordinary formula for the tangent galvanometer, and substitute the natural tangents for tangent a in the formula. Calculate the corresponding current in each case. Form a table of these currents for each angle, and keep it for reference. You will then save the trouble and labor of making the calculation for each reading; we mail you a copy of our SUPPLEMENT Catalogue, in which you will find mention of articles on the construction of galvanometers.

(9791) F. C. B. asks for a padding paste. A. Glue, 4 pounds; glycerine, 2 pounds; linseed oil, ½ pound; sugar, ¼ pound; aniline dye, q. s. The glue is softened by soaking it in a little cold water, then dissolved together with the sugar in the glycerine by aid of heat over a water bath. To this the dye is added, after which the oil is well stirred in. It is used hot. Another composition of a somewhat similar nature is prepared as follows: Glue, 1 pound; glycerine, 4 ounces; glucose sirup, about, 1 ounce; tannin, 48 grains. Give the compositions an hour or more in which to dry or set before cutting or handling the pads.

(9792) A. G. H. asks how to restore crape. A. Black crape may be freshened and made to look almost equal to new if treated in the following way: Lay over the ironing table a piece of black cambric or cloth of any kind, and pin the piece of crape smoothly through to the blanket, stretching it out to its original size. Wring another piece of black cambric out of water and lay it over the crape, patting it down with the palm of the hand. Now take hot flatirons and pass them over the wet cloth, letting them just touch the cloth, but allowing no pressure to come upon the crape. When the cloth has become dry from the heat of the iron remove it, but let the crape remain pinned down until all the moisture has evaporated and it is perfectly dry. The crape will now feel and look like new. A long veil can be renovated in this way, making sure that the part redressed comes under the edge of the wet cloth.

(9793) F. J. H. asks how to make koumyss. A. Fresh milk, 12 ounces; water, 4 ounces; brown sugar, 2½ drachms; compressed yeast, 24 grains; milk sugar, 3 drachms. Dissolve the milk sugar in the water, add to the milk, rub the yeast and brown sugar down in a mortar with a little of the mixture, then strain into the other portion. Strong bottles are very essential, champagne bottles being frequently used, and the corks should fit very tightly; in fact, it is almost necessary to use a bottling machine for the purpose, and once the cork is properly fixed it should be wired down. Many failures have resulted because the corks did not fit properly, the result being that the carbonic gas escaped as formed and left a worthless preparation. It is further necessary to keep the preparation at a moderate temperature, and to insure the article being properly finished, the bottles are to be gently shaken each day for about ten minutes to prevent the clotting of casein. It is as well to take the precaution of rolling a cloth around the bottle during the shaking process, as the amount of gas generated is great, and should the bottom be of thin glass or contain a flaw it may give way. Some few days elapse before the fermentation passes into the acid stage, and when this has taken place the preparation is much thicker. It is now in the proper condition to be used.—Pharmaceutical Era.

(9794) J. H. P. asks how to paste labels on cork. A. Gum tragacanth, 1 ounce; gum arabic, 4 ounces. Dissolve in water, 1 pint; strain, and add thymol, 14 grains, suspended in glycerine, 4 ounces; finally add water to make 2 pints. (2) Rye flour, 4 ounces; water, 1 pint; nitric acid, 1 drachm; carbolic acid, 10 minims; oil of cloves, 10 minims; glycerine, 1 ounce. Mix the flour and water, strain through cheese cloth, and add the nitric acid. Apply heat until suitably thickened, and add the other ingredients when cooling. This paste is suitable for almost any kind of labels, and it will adhere to almost anything.

(9795) F. J. C. says: Please give me a formula for library paste. A. A good white library paste may be made by any of the following processes: 1. Water, 1 quart; alum, ¾ ounce. Dissolve and add enough flour to bring to the consistence of cream, and then bring it to a boil, stirring all the time. 2. Starch, 2 drachms; sugar, 1 ounce; acacia, 2 drachms; water, sufficient. Dissolve the gum, add the sugar, and boil until the starch is cooked. 3. Rice starch, 1 ounce; gelatin, 3 drachms; water, ½ pint. Heat with constant stirring, until the milky liquid becomes thick and glassy, when the paste is ready for use. Any of these pastes may be preserved by adding a little oil of cloves, or carbolic acid, salicylic acid, or formaldehyde.

(9796) W. B. K. asks for information concerning vanilla extract. The National Druggist, of St. Louis. has published the following formulas for preparing three grades of vanilla essences, translated from the Zeitschrift für Kohlensaure Industrie: I. Vanillin, 20 parts; absolute alcohol, 600 parts; water, 450 parts. Dissolve the vanillin in the alcohol and add the water. II. Musk, 1 part; potassium carbonate, 1 part; vanilla beans, 60 parts; boiling water, 240 parts; alcohol, 720 parts. Mix the vanilla, cut fine, the musk and potassium salt, and pour over them the boiling water. Let them stand until quite cold, then add the alcohol and set aside for 14 days. Finally strain, express, and filter the percolate. III. Vanilla in fine bits, 250 parts; alcohol, 2,500 parts; water, 1,500 parts. Mix the alcohol and water and pour one-third of the mixture over the cut beans. Put into a vessel with a tight cover, place in the water bath and keep for one hour at 60 deg. C. Pour off the liquid and set aside. To the residue in the vessel add one-half of the remaining alcohol and water, and treat in the same manner. Repeat the operation with the remainder of the liquid. Remove the vanilla to an extraction apparatus, pack and extract with 250 parts of alcohol and water mixed in the proportion indicated above. Mix the results of the three infusions, filter, and wash the filter with the result of the percolation, allowing the percolate to run through and mingle with the original filtrate. To prepare a sirup with either of these essences, mix 15 parts of the essence, 8 parts of caramel solution, and 4,500 parts of the sirup, in which 15 parts of gelatin have been previously dissolved by the aid of gentle heat.

(9797) E. G. asks: I would like to receive information on the following subject through the columns of your paper. Does it make any difference how the contact is broken on a jump spark coil, that is, will it make any difference in the secondary spark? A. The mechanism for breaking contact in the primary coil does not make much difference to the spark, provided the break is made suddenly.

(9798) C. L. T. asks for a formula for japanner's gold size. A. Gum animi and asphaltum, each 1 ounce; red lead, yellow litharge and umber, each 1½ ounces. Reduce to a fine powder, mix and put them with a pound of linseed oil into a pipkin, and boil gently, constantly stirring until thoroughly incorporated. Continue the boiling until it becomes as thick as tar, as it cools. Strain through flannel, and keep for use, carefully stopped up. When wanted, grind with as much vermilion as will give it an opaqueness, and dilute sufficiently with oil of turpentine to work freely with a pencil. Or, take linseed oil, 1 pound; gum animi, 4 ounces. Boil the oil, and add gradually the gum animi finely powdered, until dissolved. Let the mixture boil to the consistence of tar on cooling, then strain while warm through a coarse cloth for use. Previous to being used, it must be mixed with vermilion and oil of turpentine, as above. This size may be used on almost any substance, and no preparation of the work is necessary, beyond having an even and perfectly clean surface. To use the size, put a proper quantity prepared as above into a saucer. Then spread it with a brush over the surface to be gilded, or draw with it, by means of a pencil, the designs intended, carefully avoiding to touch any other parts. Let it remain until fit to receive the gold, which is to be determined in the same manner as in oil gilding, by the finger. Then go over the work with a soft camel's hair pencil. The whole being covered, it must be left to dry, and then the loose powder lightly brushed off. When gold leaf is used, the method of sizing is the same, but the operation requires more nicety. There are various sorts of gold powders—pure gold powder, Dutch, mosaic, etc., any of which can be procured at the artistis' color shops ready for use. When the whole has been gilt, any parts uncovered may be repaired by wetting with a camel's hair pencil, and covering the part with gold, avoiding, as much as possible, touching the perfect gilding, as it frequently causes it to turn black.

(9799) A. L. B. asks how newspaper pictures can be transferred. A. Prepare a liquid by dissolving 1½ drachms common yellow soap in 1 pint of hot water, adding, when nearly cold, 3¼ fluid ounces spirits turpentine, and shaking thoroughly together. This fluid is applied liberally to the surface of the printed matter with a soft brush or sponge (being careful not to smear the ink, which soon becomes softened) and allowed to soak for a few minutes; then well damp the plain paper on which the transfer is to be made, place it upon the engraving and subject the whole to moderate pressure for about one minute. On separating them a reversed transfer will be found on the paper.

(9800) J. B. C. asks for a benzine varnish and polish. A. Various kinds of resin can be carefully melted, according to the variety of the varnish or polish to be produced, in hermetically closed kettles under addition of boracic acid and, after cooling, moistened with methylic alcohol. The liquid gums thus treated are completely soluble in benzine. The following gums enter into use: White or yellow shellac, sandarac, mastic, Manila gum lac, stick lac, etc., either alone or mixed together, according to whether the polish and varnish is to be light colored, yellow, or red, dull, or transparent. The percentage of boracic acid, gum, and methylic alcohol varies according to the quality of the resins employed and the destination of the varnish and polish, but in no case must the quantity of boracic acid exceed 5 per cent of the resin quantity employed, and the proportion of methylic alcohol should not, even in case the hardest and most scarcely fusible gums are employed, make up more than the weight of the resin amounts to. The contents of solid substances in the varnishes should not be less than 15 per cent and not less than 8 per cent in the polishes. According to the inventor, the benzine varnishes can not only entirely take the place of the spirit lacquers and polishes, but even afford the advantage of facilitating and accelerating the work, on account of the quicker evaporation of the benzine.

(9801) C. L. asks for a formula for red paint used on magnets. A. The "paint" used on magnets is usually non-conducting shellac varnish, carrying cinnabar. Try the following formula: Cinnabar, pulverized, 3 parts; Venice turpentine, 2 parts; shellac, pale, 1 part; alcohol, 95 per cent, sufficent. Melt turpentine and shellac, remove from fire, let cool down to about 140 deg. F., and add 10 parts of the alcohol. Rub up the cinnabar with sufficient alcohol to mix a paste, and add it to the melted mixture. Put on a water bath for a few minutes, and stir continuously, until a smooth, homogeneous fluid is obtained. Remove from fire, and stir until cold. Preserve in well-stoppered vials, and when desired for use return to the water bath, and heat until the liquid can be applied with a brush. The magnet should be warmed before applying.

NEW BOOKS, ETC.

DER EISEN-BETON UND SEINE ANWENDUNG IM BAUWESEN. Von Paul Christophe. Berlin, 1905. Verlag: Tonindustrie Zeitung. 916 illustrations. Pp. 575. Full morocco levant. Crown 8vo. Price, $8.50.

Although originally published in 1902, it cannot be denied that the work before us is a most exhaustive and valuable contribution to a subject of ever-growing importance. Mr. Christophe's work is divided into five parts, in the chapters of each of which an enormous amount of material, which he was able to gather in his capacity of engineer, has been admirably distributed. In the first part, general principles and methods of construction are discussed. In the second, methods of application are treated. In the third, the preparation of material is discussed. The fourth division is devoted to theoretical considerations, and the fifth is a thorough review of the advantages and disadvantages of reinforced concrete.

MODERN ELECTRICAL CONSTRUCTION. By Henry C. Horstman and Victor H. Tousley. Chicago: Frederick J. Drake & Co., 1905. 16mo.; pp. 345. Price, $1.50.

This work is intended as a reliable and practical guide to the beginner in electrical construction. The rules of the National Electrical Code adopted by the National Board of Fire Underwriters are contained in full and are used as a text with proper explanatory matter interspersed. The book is thoroughly practical and is well illustrated.

THE OUTLOOK OF NATURE. By L. H. Bailey. New York: The Macmillan Company, 1905. 8vo.; pp. 296. Price, $1.25.

The contents of this volume consist of four lectures delivered last January at the Colonial Theater, Boston, as a part of the University course, under the auspices of the educational committee of the Twentieth Century Club. The lectures are on the following subjects: "The Realm of the Commonplace"; "City and Country"; "The School of the Future," and "Evolution: A Quest of Truth."

THE SANITATION OF A COUNTRY HOUSE. By Dr. Harvey B. Bashore. New York: John Wiley & Sons, 1905. 12mo.; pp. 102. Price, $1.

This small volume contains many useful hints on the proper sanitation and beautifying of a country place. Its author has had a great deal of experience in his capacity of inspector for the State Board of Pennsylvania. Not only is the subject of sanitation and proper sanitary arrangements of a country house and its surroundings gone into, but the book also describes the proper method of constructing a sanitary camp. The book is very completely illustrated by some fifteen half-tone plates. We recommend it most heartily to all dwellers in the country.

PLANE AND SPHERICAL TRIGONOMETRY. By P. A. Lambert and H. A. Foering. New York: The Macmillan Company, 1905. 12mo.; pp. 104. Price, 60 cents.

The authors believe that this textbook will develop in the student the ability to think out and apply the relations between the trigonometric functions. Tables of the functions are not included in the book, as the authors consider it better that the student should use separate tables. The whole work is so arranged that it encourages the student to use his reasoning powers, not merely to memorize.

FARMER'S CYCLOPEDIA OF AGRICULTURE. By Earley Vernon Wilcox, Ph.D., and Clarence Beaman Smith, M.S. New York: Orange Judd Company, 1904. Small 4to.; pp. 619, 477 illustrations. Price, $3.50.

Believing that a digest of the results—for it is results that the farmer is after—obtained by farmers and experimenters is greatly needed, the authors undertook the publication of this work. The volume contains a large amount of valuable information which has been culled from the farming papers, the Bulletins of the Ameri-

can Agricultural Experiment Stations, and from work done in foreign stations, and by individuals, as well. The book treats fully of agricultural science and practice with regard to field, orchard, and garden crops, spraying, soils, the feeding and diseases of farm animals, dairy farming, and poultry raising in the United States and Canada. It is divided into eight main parts, which treat of Field Crops; Garden Crops; Fruits and Nuts; Cattle and Dairying; Live Stock; Poultry; Fertilizers, Soils, Drainage, and Irrigation; and Miscellaneous subjects. The cultural details of all common plants are given, and full directions are supplied for raising all sorts of crops. The various fungous diseases and insect pests that attack these crops are also fully described.

CLAY MODELING AND PLASTER CASTING. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1905. 12mo.; pp. 156. Price, 50 cents.

This is a very complete little handbook, that goes fully into the details of clay modeling. The tools and materials used are fully described, and the various processes of molding are gone into in detail. A chapter on Modeling the Human Figure will no doubt be found useful to young sculptors. The book is a compilation of matter published in Work, and any further information not contained in its pages may be had by addressing the editor of that journal.

RELIGION AND LUST. By James Weir, Jr., M.D. Chicago: Chicago Medical Book Company, 1905. 8vo.; pp. 233. Price, $1.50.

In the third edition of this monograph, the author has confined himself almost wholly to a discussion of the psychical correlation of religious emotion and sexual desire, having eliminated certain of the psychical problems embraced in the first two editions and added instead a bibliography. The book also contains considerable data additional to the thesis of the work, as well as foot notes. All notes and quotations found in the book have been carefully verified and edited. The author feels confident that the work gives the truth of the subject as nearly as it is possible to obtain it.

PRACTICAL PLUMBERS' WORK. By Paul N. Hasluck. Philadelphia: David McKay, 1905. 12mo.; pp. 150. Price, $1.

This is a complete handbook for the practical plumber, containing, in a form convenient for every-day use, a comprehensive digest of information contributed by experienced craftsmen to the columns of the Building World. The information is concise and complete, and it is made doubly valuable by the large number of illustrations, of which there are 298.

MODEL SAILING YACHTS. Edited by Percival Marshall. London: Percival Marshall & Co., 1905. 12mo.; pp. 144. Price, 50 cents.

The volume forms the fourth of Marshall's Practical Manuals. It is a very complete handbook on the construction and sailing of small model sailing yachts. Besides containing useful advice to the tyro on choosing and sailing his boat, the book contains more advanced information by experts—information which will be of benefit to the man who has had more experience in the construction of model yachts.

THE BOOK OF THE AUTOMOBILE. By R. T. Sloss. New York: D. Appleton & Co., 1905. 8vo.; pp. 372. Price, $3.

This is one of the most complete works on the automobile and its uses that has come to our notice. Starting in with the usual historical review, the author next discusses the various types of motors, transmissions, and various forms of chassis employed. Separate chapters are given to the various types of gasoline motors which have been and are now being manufactured; various types of automobile steam engines are discussed. A very helpful chapter is entitled "How to Choose an Automobile." The author goes into the cost of upkeep of various types of machines over a period of several years, besides other chapters on "How to Run an Automobile," "How to Care for an Automobile," and "The Automobile in Commerce and Sport." The book contains a chapter on touring, which is well illustrated and which has a map showing the 1904 St. Louis tour. A list of all the prominent American cars with full specifications will be found in the book which is completed by a suitable index and which has also a valuable glossary of English, French, and German terms.

THE ELEMENTS OF RAILWAY ECONOMICS. By W. M. Ackworth, M.A. Oxford: The Clarendon Press, 1905. 12mo.; pp. 159. Price, 70 cents.

The author of this text book is well known by his previous works on the "Railways of England" and the "Railways and the Traders." In the present volume he considers railways and railway business from the economic point of view. The author discusses railway capital, expenditure, and income, as well as the ever-present question of railway rates. Although only a first installment of the complete work which the author had planned, this book will be found to go into the subject very thoroughly and to give considerable interesting information.

HOW TO KNOW WILD FRUITS. By Maud Gridley Peterson, with illustrations by Mary Elizabeth Herbert. New York: The Macmillan Company, 1905. 8vo.; pp. 340. Price, $1.50.

This book contains descriptions and drawings of various wild fruits. The author has dealt only with those plants which bear attractively-colored fruits. These fruits are generally the more noticeable ones, and they do not develop until the blossoms entirely disappear. Each illustration is furnished with a description which tells the kind and structure of the fruit and which will thus aid in determining the family to which a plant belongs; while the arrangement is such that each family of a species is grouped by colors. Approximately 200 plants found in England and America are described. The book is prefaced with a suitable guide to the plant families and species described in it.

EFFECTS OF TROPICAL LIGHT ON WHITE MEN. By Major Charles E. Woodruff, A.M., M.D., Surgeon in the United States Army. New York: The Rebman Company, 1905. 8vo.; pp. 358.

The author commenced the writing of this work in an attempt to prove or disprove the theory announced by Von Schmaedel in a paper read before the Anthropological Society, in Munich, during 1895, that skin pigmentation of man was evolved for the purpose of excluding the dangerous actinic, or short, rays of light which destroy living protoplasm. This theory gave, at once, the reasons for the evolution of nigrescence and blondness, the reasons why Europeans have always failed to colonize in the tropics, and why blonds disappear when they migrate from their northern homes; and it finally gave rise to practical hygienic rules for white men compelled to reside in the tropics. As the suggestions contained in this paper were of such inestimable value provided the theory was correct, a systematic search was instituted for data; and the discoveries made in this search prove the correctness of the theory. In the present work Mr. Woodruff brings forth these discoveries and attempts to prove the theory conclusively. The subject, though a very interesting one and of great importance to all blonds in the United States, has never before been treated exhaustively, and popular scientific literature has generally ignored the real issue. Among the headings of chapters in this work are the following: Ether Waves, Their Action on Protoplasm; Difference Between Plants and Animals; Natural Defenses of Animals from Light; Known Effects of Light on Man; Actino-Therapy; Evolution of Blondness; Results of Insufficient Pigmentation; and Practical Rules for White Men in the Tropics. An index puts the information contained in the book instantly at the reader's disposal.

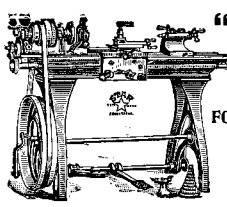
INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending September 19, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid and making same, benzoyl-salicylic, E. Bloch	799,706
Advertising device, A. A. Warren	800,036
Amusement device, A. Debattista	799,976
Ankylosis of the knee, apparatus for treating, R. R. Norwood	799,664
Annealing furnace, A. Ridd	800,018
Antisiphon trap, J. J. Smith	799,874
Auger, square, F. Bryan	799,889
Automobile steering mechanism, C. O. Barnes	799,703
Automobile tire covering, B. Nathan	799,662
Automobiles, control of, H. Lemp	800,118
Bag holder, J. C. Downing	800,087
Bale tie, Witt & Hollinger	800,042
Baling press, A. Hailey	799,729
Baling press, F. A. Lake	799,739
Baling press, L. L. Parr	800,009
Balls, machine for winding the cores for golf, Cochrane & Jackson	800,076
Band brake, A. Grieves	799,728
Barrage, J. A. Boyce	799,708
Battery grid or element, secondary, W. Gardiner	800,128
Bedstead bed rail fastener, metallic, J. Nelson	800,006
Belt shifter, I. S. Newton	799,663
Belt shifter, automatic, J. F. Ochard	800,120
Bending tool, X. Kern	799,654
Bicycle, water, Z. Payette	799,667
Binder, temporary, T. Lee	799,992
Binding posts, connecting wire to, W. Mills	799,748
Block signal system, H. N. Sporborg	799,807
Block signal system, H. E. White	799,816
Blocking and cultivating machine, T. McEwing	800,005
Blotter, ruling, J. L. Wood	799,818
Board. See End board.	
Boat, submarine torpedo, J. J. Harpain	800,101
Boats, buffer for, F. Grimm	799,645
Boats, means of escape from sunken submarine and similar, Cable & Spear	799,714
Boiler water heater, J. Miller	799,864
Book back making apparatus, A. J. Kroencke	800,115
Book mark, G. S. Budge	799,775
Book support, G. Enander	800,090
Boot, E. G. Stearns	799,685
Boring drill, H. J. Blaske	799,968
Bottle cap, H. A. Oberholtzer	799,665
Bottle, mucilage, F. W. Martin	799,747
Bottle, nursing, E. H. Simonds	799,806
Bottle protector, H. F. Thompson	800,030
Bottle or vessel, non-refillable, Crossley & Jones	799,635
Bottle stopper fastener, J. A. Astarita	799,622
Box, Inwood & Lavenberg	799,854
Brake mechanism, J. W. Miller	799,797
Brick handling machine, A. Dupuy	799,838
Broiler, gas, S. T. Willson	799,956
Building block, J. S. Culley	799,636
Building construction, G. F. Fisher, 799,784,	799,843
Buildings, traveling attachment for, T. McConnell	799,865
Bung, locking, G. W. Phillips	799,802
Button, cuff, H. L. Mainland	799,998
Cabinet, E. F. Fischer	799,725
Cabinet, kitchen, J. F. Wilmot	800,040
Cable head hanger, F. M. Winn	799,957
Camera, photographic, A. D. Davis	800,081
Can filling or other machines, can feed device for, C. H. Ayars	799,962
Cap making machine, Beck & Drushel	799,624
Car brake, T. A. Steele	799,688
Car construction, metallic, T. R. Brown	799,969
Car coupling, C. B. Botkin	800,063
Car coupling, slag, Bennetts & Jones	799,966
Car door, sliding, I. K. Walton	799,812
Car draft rigging, railway, J. F. O'Connor	799,867
Car, dump, F. S. Ingoldsby	799,650, 799,651
Car fender, J. W. Seibert	800,121
Car, freight, H. S. Hart	799,646
Car grain door, S. R. Helck	799,789
Car loading and unloading appliance, stock, W. J. Ray	799,868
Car, railway freight, W. A. Holbrook	799,905
Car wheel, J. R. Davies	799,893
Car wheel, steel, F. W. Hudson	799,907
Cars, system of ventilation for railway, L. J. Harris	799,984
Cars, tandem spring draft rigging for railway, J. F. O'Connor	799,866
Cartons, device for cutting, scoring, folding, and pasting, E. A. L. Roehl	799,942
Carving machine, J. H. Behee	799,825
Cement building block, hollow, H. D. Brooke	800,067
Cement molding machines, pattern frame for, J. B. Petrie	799,754
Chair. See Dental chair.	
Checkrein attachment, L. Moretti	799,920
Checkrein loop retainer, V. Miller	799,918
Cheese, J. R. Meyers	799,863
Chemical apparatus, D. Genese	800,097
Chuck and tools therefor, tool, J. Gessert	799,787
Chuck, drill, T. S. Carroll	799,630
Churn, L. W. Schomber	799,872
Cigar bunches, machine for forming, binding, and storing, A. S. Koch	799,991
Cigar cutter and match holding and delivering device, combined, R. E. Jack	799,909
Circuit breakers, electromagnetic lock for automatic, J. D. Hilliard, Jr.	799,790
Clamp, G. M. Henry	800,105
Clock, calendar, W. S. Shirk	799,679
Clothes sprinkler, H. G. Smith	799,761
Clutch, electromagnetic, H. H. Cutler	799,720
Coating machine, G. P. Reuhl	800,016
Coherer, W. W. Massie	800,119
Coin actuated mechanism, E. Richter	799,673
Collar protector, O. L. Harries	799,731
Comb, G. N. Steere	799,762
Concrete flume, W. L. Church	799,827
Concrete mold, J. D. Truss	799,693
Concrete wall mold, A. S. Merriett	799,914
Conveyer, L. Abraham	799,771
Conveyer, C. W. Levalley	799,993
Conveyer, C. Finn	800,095
Cooker, steam, Brown & Grant	800,069
Cooling apparatus, W. B. Allbright	799,823
Cord adjuster for holding surplus cord, H. C. Ayres	800,050
Core forming apparatus, J. F. Hay	799,847
Cores, making, J. F. Hay	799,846
Cotton chopper and harrow, Oglesby & Champion	799,932
Cotton picking machine, G. A. Lowry	799,742
Counterpane, O. Steiner	799,763
Cream treating machine, Nebel & Peterson	799,927
Crop gathering and loading machine, J. A. Berthelot	799,625
Cuff holder, M. P. Zindorf	799,822
Cultivator, C. De Freese	800,082
Cultivator, corn, Hoskovec & Roubal	799,735
Cutting and raking implement, combined, E. S. Regnier	799,669
Cutting implement, H. F. Nehr	799,928
Dam, W. L. Church	799,829
Dam, waterworks, W. L. Church	799,830
Dams, flash board holder for, W. L. Church	799,828
Dasher, I. M. Murphy	799,751
Dental chair, F. E. Case	799,972
Dental crown or plate swaging device, J. A. Reid	799,937
Dental device, W. S. Filley	800,093
Dental tool, A. W. Feltmann	799,724
Distillation of wood, etc., basket for, J. A. Mathieu	799,795
Door fastener, G. W. Niles	800,007
Door, grain, J. W. Boling	799,626
Door lock and latch, combined, C. E. Stover	800,027
Door stay, E. Anderson	799,772
Doubletree hanger, M. Kurz	799,656
Dough breaker, P. F. Carroll	799,715
Drill socket, G. A. Sager	799,944
Driving mechanism, variable speed, H. A. Coombs	799,717
Drum, heating, J. K. Mohler	800,002
Ear trumpet, G. G. Lewis	799,659
Earthenware pipes, machine for making, H. Coulthurst et al	799,833
Edge iron, S. R. Bailey	799,774
Electric contact device, R. W. Farrington	799,896
Electric current regulator, P. Kennedy	800,114
Electric wiring, conduit for, H. C. Ayres	800,052
Electrical conductor conduit, H. C. Ayres	800,054
Electrical conductors, device for coiling and uncoiling, H. C. Ayres	800,049
Electrical conduit cover, H. C. Ayres	800,055
Electrical indicator, H. Lemp	799,117
Electrical instruments, means for supporting movable elements of, E. Hartmann	799,733
Electrical wiring, angular conduit for, H. C. Ayres	800,053
Electrolier, adjustable, H. C. Ayres	800,051
Electrolytic apparatus, G. L. Meaker	799,861
Elevator lock, R. J. Roulo	799,758
End board, wagon, F. S. Converse	800,079
Engine reversing gear, steam, B. H. Brown	799,712
Engine vaporizer, hydrocarbon, F. I. Hitchcock	799,791
Envelop band cutting machine, E. A. Claus	799,890
Excavating bucket, H. S. Atkinson	800,048
Excavator, J. O'Connor	799,753
Explosive, E. Steele	799,687
Explosive, nitroglycerin, M. Bielefeldt	799,705
Eyeglasses, etc., holder for lenses of, G. H. Winslow, reissue	12,391
Eyelet and the like, W. G. Murphy	799,924
Eyelets and the like, manufacture of, W. G. Murphy	799,925
Fan motor, J. F. Thunell	799,952
Faucet, C. F. Beresford	800,125
Feed water regulator, Spanabel & Justison	799,947
Fence post, Gaylord & Conroy	799,643
Fence post, C. Warneke	799,813
Fencing tie, wire, J. J. Morse	799,921
Fender. See Car fender.	
File, letter, C. A. Grunewald	799,788
Filing drawer, vertical, F. L. G. Straubel	799,689
Filter, W. H. Little	799,994
Filter, J. W. Hill	800,107, 800,108
Filtering apparatus, J. B. Greer	799,983
Fire extinguisher, chemical, H. Mikorey	799,796
Firearm, automatic, A. O. von Augezd	799,884
Fish rod joint or union, C. A. Tredwell	799,810
Fishing gear, O. Miller	800,001
Flanging machine gage, C. B. Fairweather	800,091
Fountain, D. D. Lambert	799,657
Friction top can, Young & Symonds	799,821
Frogless switch, S. A. Renshaw	800,015
Fuse, electric, Snyder & Hardison	799,684
Game apparatus, D. Fitzpatrick	799,785
Game apparatus, I. M. Larkey	799,794
Game apparatus, J. W. Heisman	799,848
Garment clasp, Hoy & Kobmann	799,906
Garment hanger, J. L. Muller	799,923
Gas burner, J. W. Farnoff	799,842
Gas burner, J. P. B. Sadtler	800,019
Gas burner, incandescent, J. Hudler	799,649
Gas burner safety attachment, O. Friedrich	799,899
Gate, D. W. Bromley	799,888
Gate, P. H. Connolly	800,078
Gear, friction draft, G. Westinghouse	799,698
Gearing, G. Edgar, Jr.	800,088
Glass holding device, beveled, G. H. Clark	799,633
Glove, boxing, H. A. Baker	800,058
Governor, J. A. Giles	799,727
Grader and ditcher, land, A. T. Reed	799,756
Grader, elevating, L. V. Brophy	799,826
Grain crib, Powell & Gray	799,755
Grain drill, H. J. Case	799,631
Grain drill, Roby & Pattison	799,676
Grain drying apparatus, A. R. Hagner	799,901
Graphophone modulator, F. N. Foster	799,898
Grinding and polishing cultivator disks and rolling colters, machine for, C. Youngstrom	799,700
Grinding machine, W. R. Fox	799,641
Grooming device, F. K. Moseley	799,799
Guanin, making, L. Weber	799,955
Gun lock, single trigger, A. D. Houldcroft	799,852
Gun, machine, J. Boeger	800,062
Hammer, drop, B. & J. Brett	800,065
Harrow, C. W. Bowland	799,886
Harvester and husker, corn, P. Fleming	800,094
Harvester, corn, E. J. Mundale	799,750



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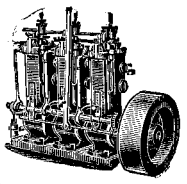

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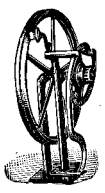

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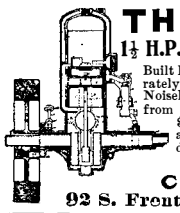

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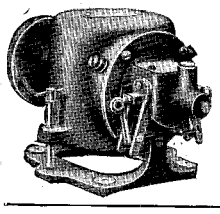

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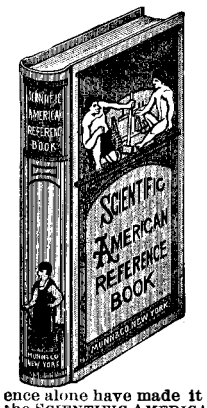

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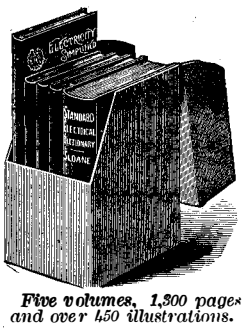

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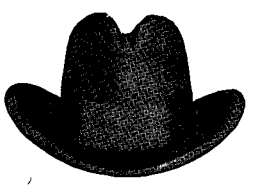

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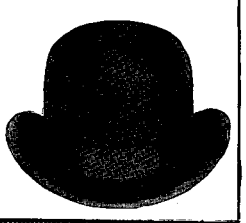

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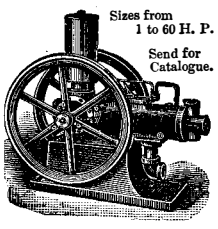

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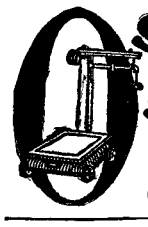

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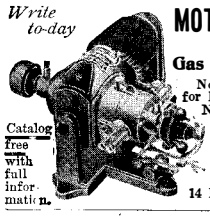

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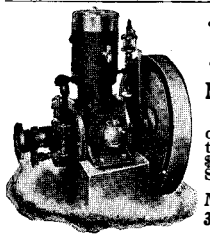

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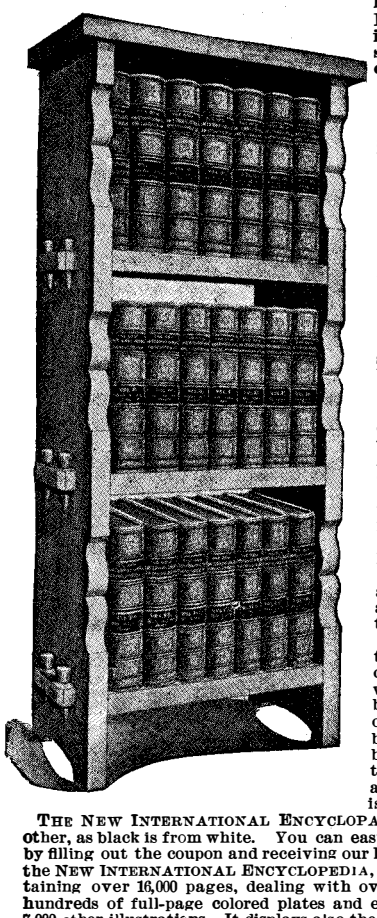

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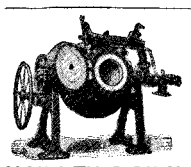

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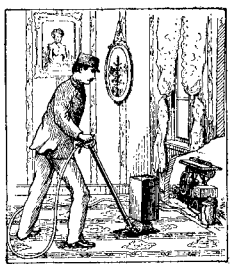

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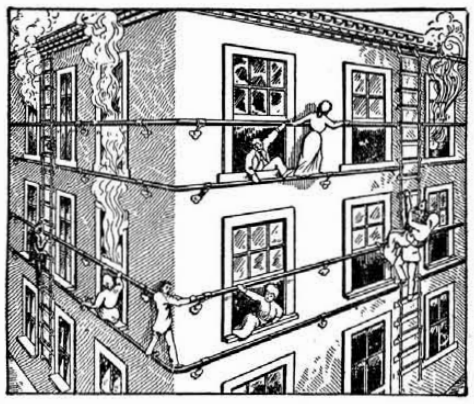

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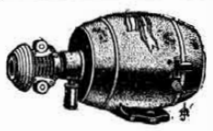

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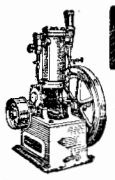

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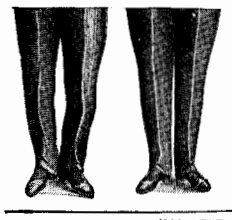

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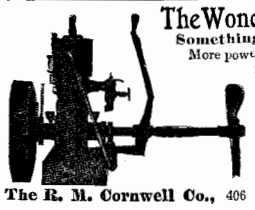

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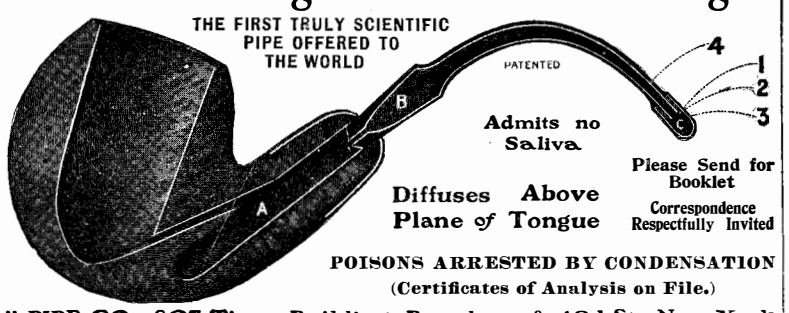

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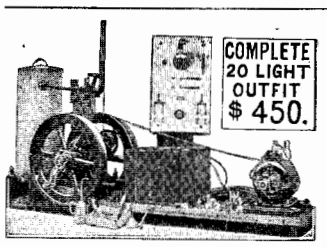

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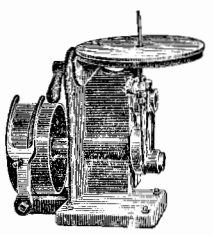

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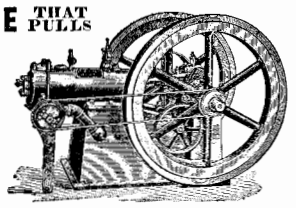

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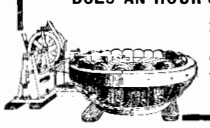

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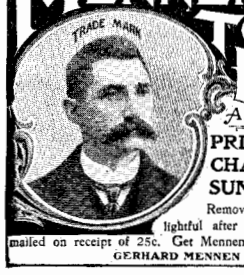

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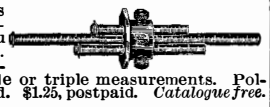

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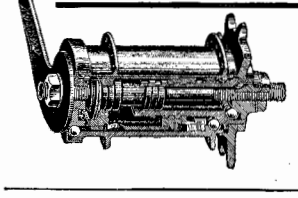

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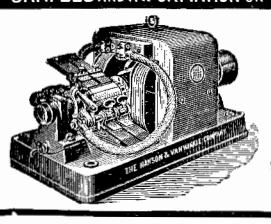

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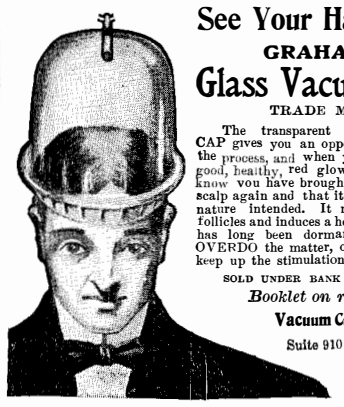

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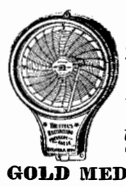

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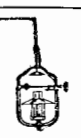

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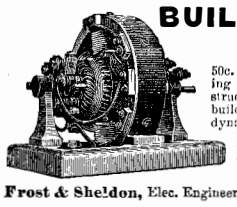

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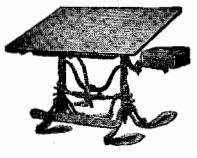

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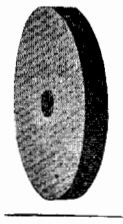

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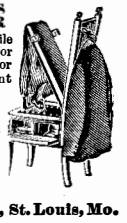

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